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Smart Cities:
Education and Course Opportunties

Marcus Wigan
Adjunct Professor Swinburne University, Melbourne
Emeritus Professor Edinburgh Napier University
Visiting Professor Imperial College London

www.mwigan.com.

Introduction

- ‘Smart Cities” is a term covering a range of capabilities driven by ICT but has wider impacts and drivers
- Example: the WHO Age Friendly Cities Initiative addresses the demographic realities: up to 30% of cities are elderly
- There are many others from diverse groups, each with their own Performance Indicators for a successful Smart City
- The Workshop today is to combine resources and perspectives on the best way of preparing students to contribute to and enhance Smart Cities as they develop
- This is the start of a process, and a follow up meeting will be held on the morning of the 29th for those still available

Scope

- Each of the many areas of Smart Cities involves the cutting edge of a range of specialities. Each demanding on their own
- The common factors are data acquisition, reduction, and application: these are the ‘easy’ technical components
- As already beginning to be apparent, the scale and speed of response to such technical enhancements will be disruptive.
- These disruptive impacts will not be restricted to each sub-field (eg medicine, education, transport) but have wider effect
- Anticipating, planning for, and the changes in governance that will be required are therefore an essential component to teach

First items to recognise for Smart education

- Education on how to work across (ever changing) specialities is essential. Mentoring works
- This applies as much to the purely technical (IoT, ITS) as to the social and governance environments
- This key goal is unlikely to be achievable by distance education, certainly not by that means alone
- The terms used for Smart Cities also include Sustainable or Resilient Cities- or indeed Age Friendly Cities - depending on the culture of the discipline
- These framings also lead to different measures (KPIs) of performance, usually additional to Smart Cities KPIs
- Data Driven* approaches v Application and control

*See Pettit, C.J, Barton, J., Goldie, X., Stimson, R. and Sinnott, R. (2015) The Australian Urban Intelligence Network supporting Smart Cities In S Geertmann et al (Eds) Planning support systems and Smart Cities. Springer

Problem Based Learning (PBL) Model

- **Given that the specialities are deep, within a single masters the key focus will need to be on enhancing collaborative skills in the Smart Cites domains**
- **Problem Based teaching in a Blended learning mode offers the best opportunities within a Masters**
- **PBL offers greatest opportunities for internships in working and developing Smart Cities**
- **The need to include Social (plus legal and economic) Sciences also fits a PBL mode**
- **MOOC style units can only be resources in such a teaching style, but this is a role they are well fitted for**

Context setting style - broad

- **High level units covering the different areas that interact for Smart Cities operation and development**
- **A viable approach, but relies on very different types of unit to cover the ground: essentially a generalist**
- **Integration at risk, and key interworking skills development omitted unless well planned for**
- **The easiest to construct – but could it address the needs?.. So let us discuss:**
- **What are the basic level knowledge required?**
- **What are the basic skills required?**
- **What are the adaptability skills required?**

Context Setting – Technican/tools Focused

- **Leads to a small core plus a wide variety of tightly focussed optional groupings**
- **Specialist groupings of units naturally lead to e.g.**

Technical Group

- Communications

- Data management

- Data and Imaging Analytics

- Geospatial integration and Visualisation

- Agent Based Models of different systems

- SmartCity ICT Project management

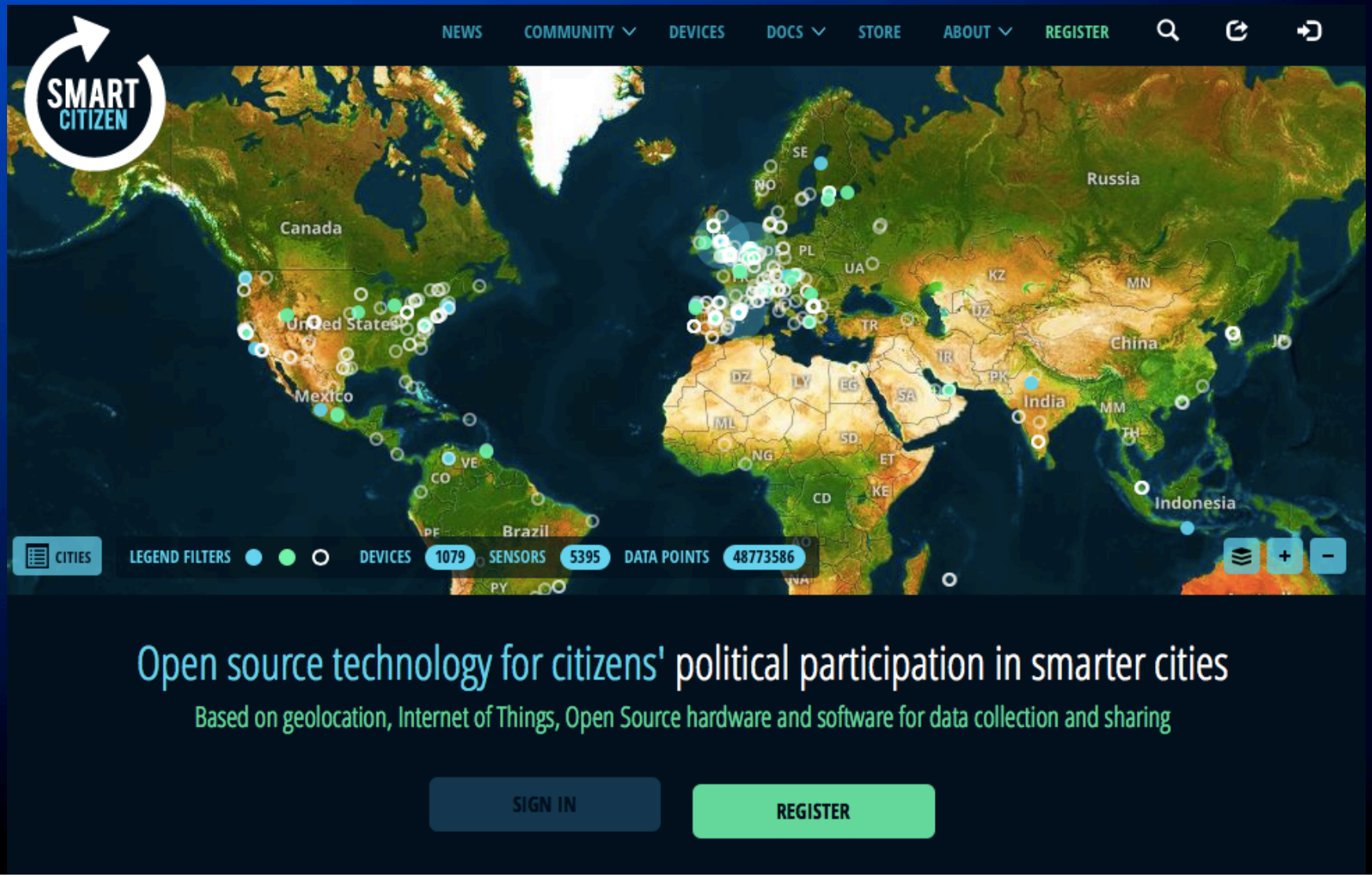
Context Setting – Socially Focused

Citizen engagement

- **The role of IPR (Intellectual Property) and Regulation**
- **Handling Privacy and Surveillance aspects of data**
- **The role of individual data and medical applications**
- **Smart agriculture: data ownership and pricing models**
- **Citizen science as data collection (https://smartcitizen.me)**
- **EU Project COBWEB as an example to draw upon**
- **Citizen science as contestable governance engagement**
- **Socio-Technical Studies of the responses to Smart Cities**
- **Governance changes and adaptive responses to these new capabilities**

Open Citizen Science: Environmental Sensor growth

https://smartcitizen.me



Context Setting – Investment Focussed

- **Infrastructure for Smart Cities will be expensive but long lasting: affected by discount rates and horizons**
- **Strategic Planning and Urban Design have similar long horizons, major impacts but not short term**
- **The attractiveness of cities can substantially enhance their creativity and economic growth**
- **Creative industries play a major role in this**
- **Infrastructure management is of growing importance: water and sanitation shares long term needs with transport, housing, and medicine**
- **City efficiency gains need to have management and decision support in addition to analytics guidance**

How to do all of this?

- **The answer is clearly that we cannot**
- **The different contexts presented will bring in different disciplines: they were to draw this out clearly**
- **One thing is certain: the technologies and data flows will press change more quickly than organisations**
- **Understanding and enabling citizen participation will therefore be essential**
- **PBL approaches can develop insights into these interdependencies: Internships will be essential**
- **It is still necessary to make choices on the base levels of skills – and which ones – or which mixes -- for entry to a Smart Cities program**

Overseas socio-technical developments

- **The resistance to, and concerns about, many of the components of Smart Cities now have secured real attention**
- **The socio-technical area of environmental studies have developed the concept of community acceptance or virtual permission as a key requirement**
- **This is now subject of an EC Project, with multi-country engagement. The term used is 'environmentality"**
- **A Key tool as Smart City sensors and data systems move steadily to *at least* partially-automated control systems.**
- **Early collaboration in and between Smart Cities – Invaluable**

P. Newton, "Liveable and Sustainable? Socio-Technical Challenges for Twenty-First- Century Cities," *Journal of Urban Technology,* 2012.

J. Gabrys, "Programming environments: environmentality and citizen sensing in the smart city," *Environment and Planning D: Society and Space,* vol. 32, pp. 30-48, 2014.

Models that can be helpful – Design factory

- **The Design Factory collaboration (http://dfgn.org/)**
- **Specifically cross discipline acculturation, with a project and problem based learning focus.**

  xxxxx Design Factory offers students new learning experiences through interdisciplinary and international activities.

  For organisations, governments and researchers we offer a platform to develop and deliver innovative solutions focused on real user needs.

  The projects offer students new and unique experiences, challenging team members to move outside of their comfort zone in order to create innovation and new thinking.

  Over the course of a project, students gain valuable skills that can set them apart in the employment market, assisting with competencies such as:

  interdisciplinary team work

  communication and collaboration

  project management

  creative problem solving

  client interaction.

Collaborators: Aalto Design Factory at Aalto University, Helsinki, Finland Aalto-Tongji Design Factory, at Tongji University in Shanghai, China Design Factory Korea at Yonsei Univeristy, Seoul, Korea Duoc Design Factory at Duoc UC, Santiago, Chile Frisian Design Factory, NHL University of Applied Science, Netherlands IdeaSquare at CERN research centre, Switzerland PACE University, New York Philadelphia University, Philadelphia Porto Design Factory at Porto Polytechnic in Porto, Portugal Riga Design Factory, Riga Technical University, Latvia

Build on and join existing global networks

- **Examples include http://wiki.osgeo.org/wiki/GeoForAll_UrbanScience_CityAnalytics**
- **Take advantage of the IEEE Smart Cities initiative networking facilities between Pilot Cities**
- **Include City staff in these processes**
- **Extend Internships between cities and projects**
- **Unit exchange arrangements (example of a data driven tools Built Environment approach UNSW 'Digital Cities MUPS006, which encompasses AURIN mass data and Nectar cloud usage)**

Lessons from recent major reviews of changing engineering curricula

Achieving excellence in engineering education the ingredients of successful change RAE MIT March 2001
http://www.rhgraham.org/RHG/Recent_projects_files/Educational%20change%20summary%20report.pdf
Project-based learning is often integral [to these two strategic Approaches]. In the majority of cases, coherent and ambitious programmes of reform involves project-based education within authentic professional engineering contexts. This pattern is evident regardless of country or institution type.

Engineering Education: Transformation and Innovation UNESCO 2015
D. Beanland and R. Hadgraft, [Eds}

A new curriculum is proposed with sufficient detail to facilitate the implementation of the pro- posed approach. It utilises the concepts of project based learning and the formation of learning communities. The curriculum is broadly based and does not require the choice of a particular engineering specialisation in the first two years. Projects are used as a vehicle to provide interest, context and motivation while developing the desired engineering attributes such as creative problem solving and innovation, capability to analyse the issues involved in a system problem, ability to find, understand and utilise information, teamwork, leadership and communication skills, ethical and environmental responsibility, and awareness of business issues. Projects would be used throughout the program with increasing complexity.

Summary

- I have had to be very selective in what I have included in this huge subject of vital importance to cities
- I have focussed on the key transferable skill of adaptive productive working between many disciplines in ever-changing technical tools and administrative structures
- Close connections with working cities are essential
- Mentoring and internships are central to skills required
- We cannot reinvent the world alone: learn enough to both reciprocate and learn in networks - including citizens
- Mixed mode learning (OnLine+in person) is needed
- Early integration of governance, investment, and legal aspects (IP, regulation, privacy) adds real practical value