IMPETUS – UoN / Smart Campus project

Wednesday 30th September, 2.30—4.30, B25

Attending:

David Aldred; Dave Burgess (for Chris Parry); Neil Davidson; Nancy Hughes; Sue Jones; Emma Kemp; Andy Nolan; Sarah Sharples; Andrew Ward

UoN as a Smart Campus

The potential for and interest in developing the University of Nottingham as a Smart Campus, is considerable and growing. By Smart Campus, we mean a campus that is an efficient, safe, sustainable, responsive and enjoyable place to live and work, underpinned and enhanced by digital / internet based technologies. This interest was clearly demonstrated at the recent 'Intelligent Mobility – Campus of the Future' workshop, held at the UoN (26th May 2015), which was well attended by academics from a variety of disciplines, in addition to representatives from Estates and Professional Services. The UoN campus is an ideal environment and 'vehicle' through which to research, develop and evaluate a diversity of Smart Campus, and potentially Smart City concepts, being embedded within an existing city, multi-site and encircling a major hospital. Indeed, using the campus as a 'test-bed', is of particular interest to Nottingham City Council (Alison Stacey, Business Growth Development Specialist, NCC), as it would enable them to both monitor behaviours e.g. pedestrian movement and car-parking patterns, and also trial innovations e.g. autonomous vehicles (LUTZ pathfinder/Pod), in a meaningful yet manageable way. The importance of 'top down' support from government and local/city councils, combined with 'bottom up'/ SME products and innovations (in addition to strong public buy-in and rigorous evidence based trialling), are all seen as crucial to the success of any Smart City ('Leicester 2030: Our Future City', De Montfort University, 27th October '15).

In addition to the obvious benefits of a more efficient, connected and responsive campus, such a campus would also enhance and reinforce the University's reputation as a progressive academic institution, something strongly supported by Professor Karen Cox (Deputy Vice Chancellor) and the UEB. Such potential benefits and support are also likely to strengthen the case for further funding e.g. from the University's HEIF fund; Horizon Digital Economy Research Institute – 'Services' theme; and /or the Health Foundation (UP and JC being adjacent to the QMC).

Despite such irrefutable benefits however, the reality of developing a Smart Campus is a highly complex and challenging undertaking. The term 'Smart Campus' itself, can have a wide range of meanings for different University stakeholders e.g. Estates, Security, Sustainability, Planning and Strategy, not to mention the staff and students. Understandably the motivations and goals of these groups, in pursuing a Smart Campus, also vary enormously e.g. identifying student / pedestrian movement as the basis for locating key services; identifying inter-campus bus use as the basis for more efficient demand-driven provision; and/or monitoring building occupancy to reduce potential

energy consumption. Indeed, there are already a number of ventures currently in place on campus, addressing key issues relating to transport, energy, learning provision and environmental management, e.g. the Campus wide use of electric vehicles and free bike hire / maintenance, to IT recycling programmes. However, within the context of the IMPETUS project, the meaning of and motivations for a Smart Campus, is something we are continuing to discuss and define.

This said, before we can address the complexity of challenges that developing a Smart Campus poses, it is crucial that we first formalise what the key issues are, and for who; what we need to do as opposed to what we can do (i.e. have the technology and data to do); and identify what has already been done, both internally and externally e.g. Glasgow, Manchester, Cranfield, UCL. Indeed, an awareness of the later, would not only help to avoid simply replicating the work of other Universities, but enable us to focus our efforts on what we do well or differently. It is also imperative that we are 'people' rather than 'hardware-centred' ('Rethinking Smart Cities from the Ground Up', NESTA Report, June 2015), and avoid simply finding uses for new technologies and data, rather than focusing on the actual needs of those that use and service the campus.

Current 'smart' services, emerging issues and future aims

As indicated above, there has already been a variety of work undertaken at UoN to support the development of a Smart Campus, either directly e.g. the monitoring of waste bins by weight, or indirectly e.g. the collection of staff / students' positional data. There is also an increasing awareness of the importance of engaging with these issues. For example, Neil Davidson (Planning Unit Manager, Strategy, Planning & Performance, UoN) identified the impact that 'timetabling' has upon a range of other services, e.g. Hopper bus provision and overall staff / student experience. He discussed the on-going challenges of timetabling and the ideal of more 'personalised', responsive scheduling of lectures etc.

Andrew Ward (Head of User Experience, UoN) discussed the recent advances in being able to monitor people's movement around the Campus and the high levels of accuracy now achievable, largely due to increases in coverage (e.g. NCC investing in wireless, Eduroam, BT). He also stressed the importance of such positional, locative data upon timetabling, but stressed the potential ethical / privacy issues that arose from having access to such information. Andrew was also happy to offer a proportion of researcher Clare Murphy's time, to work on students' opinion / mobility surveys etc.

David Aldred (Head of Web, UoN) highlighted the availability of the Google, room and floor level on-line maps and commented on the need for more robust data to support 'Open day' activity. For example a more 'technological' approach to counting car admissions, rather than the current manual tally; an awareness of which other Universities 'UoN open day' visitors had gone to; and the use of CCTV to establish chosen routes between buildings and the potential impact of poor signage and barriers on people movement. He also suggested the value of being able to identify whether people were staff, PG or UG and the benefit of social media and 'sentiment analysis' within a Smart Campus context (the process of computationally identifying and categorizing opinions expressed in a piece of text e.g. tweets).

Emma Kemp (Senior Environment Officer, UoN) commented on some of the challenges that Estates / Sustainability face in running the Hopper Bus service efficiently and in-line with demand between campuses. She pointed to the recent 'Travel Survey' data analysis, as a source of evidence for route / mode of transport preferences and choices.

Andy Nolan (Director of Sustainability, UoN) reinforced this, by introducing the benefit of 'scenario mapping' to understand people's movement; what would be the impact of further developments to the Jubilee Campus upon people movement?; where do people identify the 'centre' of JP to be? Like David Aldred, he reiterated the need for more accurate and robust technologies to automatically count cars, replacing the current 'point in time' manual tallying of vehicle admissions and parked cars. Such measures enabling a more responsive car-parking and movement strategy. He was also keen to encourage a re-scheduling of the standard working week, in conjunction with possible scaled parking charges dependant on the time / day, in an attempt to redistribute to load on parking. He also confirmed that the UoN 'fleet' of electric vehicles could be monitored in terms of location, speed, efficiency and that the weight of bins is monitored to prioritise collection, although the location of showers and toilets is still often not mapped. He stressed the importance of a more effective 'transport supply chain system' i.e. to better schedule service / delivery vehicles on campus. He also highlighted the need for better 'building management services' i.e. to understand building occupancy for the purposes of energy efficiency, e.g. Schneider's BMS and the Creative Energy Home initiatives.

Based upon these discussions, a number of 'research questions' were formulated as the basis for 8 potential IMPETUS / TSC internships, to run between July – September 2016. These questions are listed below, loosely grouped into 'issue areas'.

Potential research questions / internship titles

Movement of people

- How do people move around the Campus (Andrew Ward looking into this); how do people move around a Building e.g. Pope / Coates? Is it how we expect?
- How do we model the impact of path closures on pedestrian movement?
- Where, when and why does pedestrian congestion occur on Campus?
- How do people move around a developing site when their survey knowledge, positional cues and potential routes are constantly changing i.e. Jubilee?
- What design interventions e.g. artwork, signage, landscaping might best support people movement?

Inter-Campus travel

- Why (when & how) do students, staff, UoN services, move between Campuses?
- How might we best exploit / use most effectively the Hopper bus, car and bike parking data e.g. real time data for the Hopper - to improve accuracy and prediction?
- How might we best exploit / use most effectively the Travel Survey data?
- What is the impact of timetabling rules on traffic patterns?
- How might we use timetabling as a predictor for trip generation?

Understanding Campus Users

- Need to elicit different Campus users key issues and needs on, and between Campuses e.g. staff needing to move quickly between Campuses with materials for lectures; an 'Open Day' visitor needing to plan the time it will take them to walk between different demonstrations/buildings etc.
- How might we use social media and 'sentiment analysis' to support people effectively on Campus?

Personalised services

- How do we develop more responsive, adaptive, 'personalised' information when moving around campus e.g. walking time from point to point, lecture to lecture; which tram stop is nearest; is there a tennis court free on Jubilee?
- How do we identify relevant services e.g. toilets, ATM, bus stops?
- How do we use data, tracking + voice recognition? to tailor services e.g. differential parking charges.

Parking

- How might we use smart signage to support parking and tram use?
- How can we count / know how many cars are on / parked on Campus? Cost and accuracy of alternative solutions-technologies.
- How can we use our data to understand the location / timing of car and bike-parking?

Supporting Visitors

- What are the key visitor behaviours on Campus?
- How could we develop and improve the 'Open day' app?
- Develop an app for those attending conferences.

Other

- How do we use our data to support the logistics of deliveries / suppliers arriving on Campus-smarter supply chains?
- How can we use our data to aid Building Management Services to understand / respond to building occupancy?
- How do we handle / process increasingly large data sets e.g. wireless movement data from Open Day?