Use of People Counting Technologies in Europe and Beyond

TEFMA Maurie Pawsey Scholarship (2022) Study Tour

Blair Daly
Director: Estates Policy, Planning & Performance
Auckland University of Technology

Contents

Executive Summary

Occupancy numbers are fast becoming a key data point for university operations. The information is critical to many areas of facilities management, including cleaning, efficiency, movement around campuses and effective design. This study tour looked at how the data is used in the United Kingdom and Europe and compared it to use in Australasia. The data is equally important in both European and UK universities as it is for those in Australasia, and the desire to utilise this information was common across all regions.

Different types of occupancy measurement are available, and it is important to know how the data will be used to ensure that the right approach is taken. Whether the space is used or not used may be more important that how many people are in the space, or there may be a need for certain data around the users of the space.

Once the approach is decided, the data can be utilised for a variety of reasons. Some universities are using the data to help allocate cleaning resources on a 'needs' basis. Others are using it to increase efficiency with a priority on reducing space and working to meet sustainability goals. Measuring occupancy can also be useful in measuring satisfaction rates for newly built or refurbished space or for looking at attendance practices of students and staff. This information can be instrumental in trying to achieve certain outcomes.

All of the institutions visited had plans to increase their use of the data. The ability to integrate with Building Management Systems to better manage security, lighting and heating or cooling was a common desire. Other companies are considering timetabling solutions where rooms can be allocated, week by week, based on the numbers attending.

The greatest barrier to achieving these goals is generally considered to be the ability to manage complex integrations and having the staff with high level knowledge of these very complex systems and the appetite to integrate the various systems to achieve automation.

Introduction

As a result of a Maurie Pawsey Scholarship, I travelled to Europe to visit universities in England (Sheffield Hallam University), The Netherlands (Fontys University of Applied Sciences, Eindhoven University of Technology, Hanze University of Applied Sciences, Groningen University), Sweden (Chalmers University of Technology, Stockholm University, KTH Royal University of Technology) and Norway (University of Agder). I also met with two companies who are marketing People Counting software (12CU and Twiqel) and attended two conferences (the Association of University Directors of Estates Conference – AUDE - and the TimeEdit Summit). The underlying motivation of the tour was to understand more about the way different universities are using people counting software, use of technology solutions to measure and manage on-campus attendance and to see different ways that data can be utilised to gain a more efficient campus.

Types of Sensors

The various universities all utilised a variety of sensors to measure occupancy. Many institutions employ Wi-i to measure occupancy, while others use cameras. European privacy standards are some of the most stringent in the world, and these dictate the ways these technologies are used.

Wi-fi has the benefit of incorporating existing infrastructure though different services (such as "location services") may allow more accurate or varied data to be collected. There are some concerns around whether all students use Wi-Fi, but counts are reported to be largely accurate.

Camera technologies also vary – with thermal, standard and face recognition technology available. These require additional infrastructure to be installed but can reduce a lot of privacy concerns with all the processing happening on the unit so that no pictures being transmitted over the system.

In addition to these technologies, there are also "present or not present" sensors being used. These might include motion sensors or CO_2 detectors. These have the capability to say whether a location is occupied or not, but not provide numbers. These tend to be used in group study rooms or for unallocated desks that have been booked.

Uses of People Counting Technology

The universities visited used a variety of these technologies for a range of purposes. Many utilised the data to get counts of students in classrooms. Sheffield Hallam University used wi-fi data to measure the use of their classroom spaces. They had a perception that many of their bookings were not being used, however when they got the data, they were able to see that the bookings were being used but

not for the full time. The bookings were either being started later than the time booked or were being finished earlier than the end time of the booking. This is an issue they are now looking to address.

Measurement of use of office areas and numbers of staff on campus was another use. Fontys used separate counts of staff and students on campus to gauge use of, and requirement for, carparking on their campus. Using Wi-Fi allowed them to separate staff counts from student counts for more granular results.

Stockholm University were also using sensors to better gauge use of office spaces (rather that classrooms). The data has been used to better prepare their estate for work patterns after the pandemic. In general, they are finding 40-50% use of offices. KTH were also using Wi-Fi to measure numbers of staff on campus, also finding that use of office areas was low.

Use of student group study rooms was another use case, with University of Agder running a project to look at uses of these spaces in response to complaints from students that there were not enough provided. The project found that many of the bookings were not being used, so the shortage was in being able to book spaces rather than use. By implementing a better booking system and tying this into the data around usage, they were able to better use the spaces they had rather than build more. The next step is to cancel bookings that have been made but not used in order to free up space for other students.

Timetable data was generally used for managing security of rooms, and many universities were keen to look at people counting data to relock rooms if they were not being used. Sheffield Hallam and KTH were both automated their unlocking of rooms according to the timetable and Fontys commented that their security team use the data to identify people who may be stuck in buildings after hours.

Many of the universities visited were using people counting information to inform cleaning. Sheffield Hallam are currently providing timetable data to their cleaners for them to mage their resources. In the future they plan to give cleaning supervisors access to the dashboard with people counting data so they can better manage the cleaning of facilities. Fontys commented that they will be renegotiating their cleaning contract to include management of cleaning based on the actual usage of facilities.

Almost all of the institutions visited were using their data to identify heavily used or underutilised spaces in buildings. Sheffield Hallam have adjusted some office spaces to be online learning spaces for staff and students. This was based on the usage data for those areas.

Fontys used a lot of the data to design how space will be set up. Their data showed buildings that weren't well used and they would make efforts to improve the space. One solution that has worked

for them is installation of a coffee machine. They saw a noticeable increase in use of one, underutilised space after a coffee machine was installed.

They were also able to identify which groups of students were using particular spaces and could better manage provision of space. For example, they noticed that ICT students did not use cafes, so a new building for this area of the university was designed without a café.

People Counting data was also used to identify popular types of space and to look at why they are popular. These layouts that work can then be replicated in other buildings. Fontys noticed that many of their students were actually attending a library on another campus so looked at what it was that made that space popular with students. They have plans to replicate that on their campus.

In the United Kingdom, along with Australasia, sustainability is a big focus for tertiary institutions. Faced with the "Road to Net Zero", institutions are looking at how they can reduce their carbon footprint. In a panel discussion at AUDE conference, the topic of reducing the Estate is a better way to achieve carbon reduction. This will involve better data around how and how often spaces are used.

Fontys took an approach where they were able to identify where buildings were being used by few people outside their main teaching hours and then restricted access to those buildings. Through the usage data they could see that they had 15 buildings with about 20 individuals in them. By relocating those people into a smaller subset of buildings (both teaching and individual study areas) they were able to reduce the number of buildings that needed to be heated and lit.

University of Agder followed a similar approach, albeit from a different motivation. They had complaints from students that there were not enough group rooms for studying in so decided to analyse the use of the space. While not using sensors, their audit of these spaces showed that many of the bookings were not used. They introduced an improved booking system, then used sensors in the room to detect whether the booking was actually used or not and where it was not used within five minutes of the start time, by two or more people, then the booking was cancelled, and the room made available for someone else to use. The university found that this had solved the problem and no extra spaces were required.

Sheffield-Hallam University also found that people not showing up for bookings was an issue. They initially felt that this was due to no-shows, but further analysis of their wi-fi based counting solution indicated that bookings were actually being made for longer periods than they were actually being used. They are hopeful that by reducing these "late starts" or "early finishes" they will be able to enable more time for others to use and reduce the need for any more space.

Another application utilised by Fontys was to identify how often students come in during the week. While their Wi-Fi counting system does not identify individuals, it is able to recognise where one person returns to campus during a one-week period. This was useful to measure patterns of attendance. It also indicated that rather than seeing less students on campus, they actually have the same number attending, but for less time than they were pre covid.

Fontys also have the ability to identify specific users. They call this "whitelisting", and it is used to identify first aid qualified staff (with their agreement). If staff need assistant in an accident or medical emergency, they can identify those staff who may be able to assist.

Future Plans for People Counting Technology

Many of the universities visited, along with the vendors, had ideas of how they want to use the technology in the future.

12CU are developing plans for identifying anyone who has not evacuated a building during an emergency. In the case where the alarms may not be working in an area, or students are wearing headphones, their system would highlight areas with people still ion them. This could then be targeted by first responders to ensure all staff have vacated the building.

TU Eindhoven were keen to run a campaign around the cost of running a building. They would like to display the information on running the building from the Building Management System, along with numbers from the sensors they have in those buildings. This will provide a visual link between use of the building (and potentially costs) and the number of people using the building. They are also hoping to link BMS operation to the data from sensors – a concept AUT would also like to investigate. This might include setting HVAC based on occupants in real time. For instance, a large room with few occupants would be more appropriately cooled or heated than it would if there were numbers closer to its capacity. Where a window is opened, it already overrides the HVAC system to prevent wastage.

TwiQel have developed a concept called "Adaptive Scheduling" where rooms are allocated, week by week, based on actual attendance from the previous weeks. Under this approach, students would check screens, similar to those used to locate gates in airports, to identify their rooms for the current week. The software's algorithms would consider numbers attending, least amount of walking, "communities" or rooms for first year students in allocating the most appropriately sized rooms to the activity. They could also allow lecturers to make their own selections for rooms from those available at that day and time.

TwiQel are also looking at reporting tools that could show occupation of rooms measured against utilisation and other desirable factors, like gaps in student or staff timetables, allocations within communities of rooms and travel times. These graphs would be displayed as spider web graphs so that the conflict between each desirability is also clear to be seen.

This technology would also allow for predictive counts, similar to Google's predictions of numbers of people in stores at certain times or expected traffic for a specific hour. This data could then, proactively provide expectations of cleaning required, inform settings for HVAC in university rooms and provide insights for on-campus catering or retail.

Issues

Getting multiple systems to talk to each other is a common issue with all the universities visited. The complexities of Building Management Systems, coupled with constantly changing occupancy numbers create a perfect storm for basing the operation of the former on the latter. Add to this the risks of something going wrong and rooms not being opened, heated or cooled or lit and the repercussions are potentially disastrous.

The complexity of modern BMS systems also create a potential issue of having staff with the skills to manage them. New technologies and programming systems require greater knowledge and more up to date familiarity than some staff may have. The programming of such systems also relies on the use of changing data from other systems rather than the static capacity of the room or an unchanging schedule of use.

Another issue is the fact that short notice changes to data have to be interpreted correctly. If a class group go to visit a specialist space before returning to the room they have booked, the system has to recognise this and operate correctly, rather than cancel a booking under the assumption that the class is a "no show" for that day. This makes for complex programming to ensure that students and staff are not inconvenienced in the interests of automation.

Another issue identified at Groningen University was the use of cost saving measures by their ICT division. They had recognised that they could shut down some Wi-Fi senders in times where there were fewer occupants on a floor or in a building. This caused problems with their Wi-Fi based counting system in adapting to this and being able to identify the locations of students.

KTH Royal University of Technology also identified an issue with having appropriate data in case of an issue that prevented data being passed to a BMS system. They always sent seven day's worth of data so that in an outage, there would always be enough data to continue running the systems.

Conclusion

There is very little difference in the way that English, European, New Zealand or Australian institutions are using people counting data and there is a common desire to have good information to make decisions and to automate systems based on occupancy.

The key driver for deciding the type of system to implement is in identifying how and why you want the data. The uses for people counting data are wide and varied, and all institutions have a growing list of ways the data can be used. Whether it is to verify timetabled sizes, to see how new designs are being received or to manage service provision, there is a university doing it. More and more use cases are being applied and future technologies are making it easier to see benefits in a variety of environments.

The main issues with making use of the data effectively revolve around complexities of systems and the way each system uses the data. Increasingly complex capabilities of building management systems result in a need for technically capable staff to be able to leverage the data and functionality available. Unfortunately, when there are issues, it is students and staff who will be most inconvenienced so this has to be managed carefully.

The Maurie Pawsey Scholarship has allowed me to travel across Europe and the United Kingdom and meet capable, generous staff who are exceptional at what they do. I have relished the opportunity and have been very grateful to everyone for their assistance. The scholarship is a very worthy opportunity for any Facilities Management staff and I heartily recommend anyone to apply for it in the future.

Thank you

A special thank you to Robert–Jan Bulter and Steinar Morland (TimeEdit) who put me in touch with key contacts at each institution.

This trip would not have been possible without the assistance of many people. I am very grateful to the following for their contribution to my visit:

TEFMA

AUDE

Sheffield Hallam University – Donna Porter

Fontys Hogeschool

TU/ Eindhoven – Simone Vonken, Niels Oprins

Groningen University

Hanze Hogeschool – Mart Kammer

Chalmers University – Mikael Bodell, Anne-Marie Endresen, Lina Haglund, Mari Olsson, Lena Peterson, Alexandra Priatna

KTH Royal Institute of Technology – Caroline Boivie Ekstrand

University of Agder – Kevin Adriaansen, Tonje Rorly, Aasa Galteland, Janne Fladstad

12CU – Eric Vermaat

TwiQel – Rudy Oude Vrielink

TimeEdit – Robert-Jan Bulter, Steinar Morland, Richie Teh, Johan Blomfeld

If I have missed anyone from this list, I humbly apologise. Please know that your contribution was also appreciated and core to the success of this learning journey