Campuses Need to be Fully Spatially Enabled

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Colleges and Universities strive “to create knowledge, to open the minds of students to that knowledge, and to enable students to take best advantage of their educational opportunities.” A spatially enabled campus is better suited to the creation and dissemination of knowledge and what is currently lacking to achieve a fully spatially enabled campus are methods of accurately determining individual location and presence.

What needs to be in place for a spatially enabled campus?

Many campuses have a geographic information system, space system, and facility and asset management system(s). Spatial enablement starts with having these systems in place and having them integrated by sharing common spatial nomenclature so data can be matched spatially. For example, floor plans georeferenced so that they are placed in the campus context and assets that are located by room identification and/or coordinates. This integration can be expanded to include human resources, financial, transportation, security and other systems. Not until a core of integrated spatially aware systems is in place can the full potential of an enabled campus be realized – a campus where individuals can take full advantage of the campus context and a campus that can use the presence of individuals to support planning and operations. Until the location of the individual is accurately known there is no way to answer these questions: “how close is?”, “how to get there?”, “what is going on nearby?”, “what information should be conveyed to this person because they are here?”, “where is this person?” and “Is there anybody present?”.

Thinking big requires a campus that is spatially aware of the individual and critical assets in its entirety across its facilities both within and outside of buildings with a level of accuracy that is not achievable using current GPS and Wi-Fi methods. There must be locational infrastructure on which the campus population and visitors can rely. To achieve this end requires development of location technology and devices that are as ubiquitous as data jacks, life safety systems, and lighting fixtures. The technology is available now and all that is needed is the demand to create the financial incentive for development. Two methods of location are needed. The first is enablement of the individual through a smart device to accurately determine their location inside and outside of buildings and the second is the ability of campus systems to identify locations where individuals are present independent of the presence of a smart device. Privacy must be protected so sharing of location and individual identity should be left to the individual and presence detection needs to be anonymous.

One possibility for the individual to identify their location could be the development of a uniquely identifiable transmitter that incorporates ultrasound and radio waves (like blue tooth) that emits simultaneous sound and radio signals to enable smart devices to determine their precise location based on a dataset of transmitter locations, distance based on lag between
radio and sound wave, and triangulation of multiple sources. The ability to detect the presence of individuals in a location could be provided by sensors that detect motion and relay presence via wifi or other network system to a central system and database. This method of presence detection will provide better information for building usage, systems and emergency response than requiring the presence of a smart device (which can be present without a person or an individual may not have one).

The transmitters and sensors could be embedded in life safety or lighting systems equipment like exit signs, emergency lighting, or light switches. This would be similar to current implementation of motion detectors in the light switches. This way the devices can easily be incorporated into new construction and campus furniture and they can be easily retrofitted into existing facilities. They would need to be inexpensive, have low power requirements and remain functional in the event of a power outage. The technology, methodology, and algorithms should be unencumbered by licensing and patents to minimize costs. With the advent of building information modeling for new construction and renovations there is the capability to incorporate the devices into geo-referenced three dimensional models and extracting the transmitter and sensor locations.

What opportunities does spatially enabling a campus create?

A spatially enabled campus that enables individuals to be spatially aware of the campus context and that enables the campus to be aware of presence can be leveraged to support creation and dissemination of knowledge, to enable students to take greater advantage of the educational experience, and to allocated resources appropriately.

(1) **Information collection** that supports campus planning and operations so that facility systems, services and energy savings maximize resources for pedagogical priorities. This spatially aware information supports efficient use of space and energy, a safe campus environment and provides core information needed to support programming and physical planning. Information collection methods include user generated geographic information, crowd sourcing, presence information collection through sensors. Examples of applications include crowd sourcing facility condition issues, synthesis and analysis across time with spatially integrated systems and datasets to develop holistic campus models for usage of facilities over time to determine operational efficiencies, the ability to implement hoteling to reduce office space requirements, and development of dashboards that support operational activities in real time. Why clean a room that no one has been in since the last time it was vacuumed?

(2) **Creation and dissemination of knowledge** by reducing barriers to collaboration. Examples include ease of locating collaborators, arranging meeting locations, changes to teaching methodology whereby faculty hold office hours where the students are located by broadcasting availability and location.

(3) **Geo-centric Information sharing** by broadcasting information to individuals within a geographic area or posting information to a geographic location for public or group use. Examples include broadcasting educational, amenity related and emergency announcements to individuals within a portion of the campus.
(4) **Campus Amenity** that is used for social interaction. Examples include peer to peer “this is where I am (or we are) now.”

**How can the case be made to spatially enable a campus?**

The case for a fully spatially enabled campus needs to be made with university administrators. Having industry examples that illustrate the usefulness of a spatially enabled campus will assist in this process. These examples should be focused on innovations in education, planning and/or operations that have led directly to improvements and/or savings. The examples need to be showcased in appropriate journals (not an ESRI publication) and should not focus on the spatial enabled campus but on the innovation itself. For example (hypothetically) an article in the Chronicle of Higher detailing a program by which faculty have dramatically increased their face time with students by moving office hours out of their offices into dynamic learning spaces (which by the way was made possible by a spatially enabled campus). For these examples and for full implementations, measurement should be in place to determine usefulness and return on investment. Usefulness might be measured by determining whether the spatial infrastructure is being used regularly and has been incorporated into systems and decision making. The ROI will need to be determined by demonstrating improvement in services, energy savings, and more efficient space use resulting in reduced space needs. We will likely find that over time the spatially enabled campus will be the expectation and not the exception.

1Harvard College Mission Statement