# Chapter 16
# A Case Study for eCampus Spatial:
## Business Data Exploration

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## ABSTRACT

*Location based querying is the core interaction paradigm between mobile citizens and the Internet of Things, so providing users with intelligent web-services that interact efficiently with web and wireless devices to recommend personalised services is a key goal. With today's popular Web Map Services, users can ask for general information at a specific location, but not detailed information such as related functionality or environments. This shortcoming comes from a lack of connection between non-spatial "business" data and spatial "map" data. This chapter presents a novel approach for location-based querying in web and wireless environments, in which non-spatial business data is dynamically connected to spatial base-map data to provide users with spatially-enabled attribute information at particular locations. The proposed approach is illustrated in a case study at the National University of Ireland in Maynooth (NUIM), where detailed 3D campus building models were constructed. Non-spatial university specific business data such as the functionalities and timetables of class rooms/buildings, campus news, noise levels, and navigation are then explored over the web and presented as both mobile and desktop web-services.*

## INTRODUCTION

Tools for spatial exploration are provided today by free products such as Google Maps and Google Earth with satellite and street views. Users can search a street address on the map, then explore the location in street view mode, or find how to reach a certain address or location providing options like pedestrian route or driving route, etc. The query tools available in these products are usually limited to keyword-based search. At larger local scales, where detailed 3D geometries and associated business data are needed, there is a general lack of related information and search functionality for in-depth exploration of an area (PhamThi, Truong-Hong, Yin, and Carswell, 2013). Moreover, such generic products do not provide domain-specific information, highly relevant for the users.

For instance, the following types of questions cannot be answered when interacting with Google Maps/Earth on a typical university campus: what classes are scheduled in that room over there? Whose office window is that up there? What buildings/classrooms/labs can I actually see around me while standing at a specific location on campus? In order to answer these types of specific questions, Location Based Services (LBS) need to link spatial (map) data with non-spatial business data. Spatial data deals with detailed topology and geometry or coordinates of objects while business data can describe the attributes or semantic aspect of a related object in some business domain, e.g. a university campus (PhamThi et al., 2013)).

In general, geospatial data tend to change at a slower pace than business data. Furthermore, conventional business data is often managed and produced by traditional enterprise information systems, often ignoring the spatial dimension. Thus linking spatial data and business data in one application helps to enrich the user experience by fulfilling more specific user needs. In particular for task specific decision making applications that need access to detailed local scale data typically found in zoos, museums, hospitals, shopping malls, a university campus or retail/office park settings.

Business data is often indirectly or virtually associated to spatial data via its location given by a generic address, a room number, a building name, or even lat/long coordinators of the business location. Such business data can provide further detailed information to users about the objects in question and be tailored or application domain dependent. For instance, in a university campus environment, the business data involved may be in the form of class schedules for a specific room, lists of equipment installed in a lab, office hours or contact details for a lecturer, today's special meal deal in a cafeteria, etc.

Typically, 2D "footprint" data provides just flat geometry representation of physical objects (e.g. buildings) in the horizontal plane. But for this linked spatial/non-spatial data application, we need spatial and non-spatial attribute details in the vertical dimension as well for in-depth 3D BIM (building information modelling) data query operations. Depending on how much 3D geometry data is captured and how available any related business data is, more informative task specific answers can be provided to the user. For instance, 3D BIM data of a building can include detailed digital representations of physical and functional characteristics for its different floors, rooms, windows, and doors where all "things" are potentially available for interrogation.

As a case study, we describe in detail the prototype of a system in which these ideas were implemented. Within the framework of the StratAG project (http://stratag.ie/), an eCampus Demonstrator was developed for the National University of Ireland Maynooth (NUIM), in collaboration with Dublin Institute of Technology (DIT), and University College Dublin (UCD). This web-based GIS application aims to assist users in exploring and analyzing their surroundings within a detailed data environment; in our case, domain specific university business data is linked together with 3D spatial built environment

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