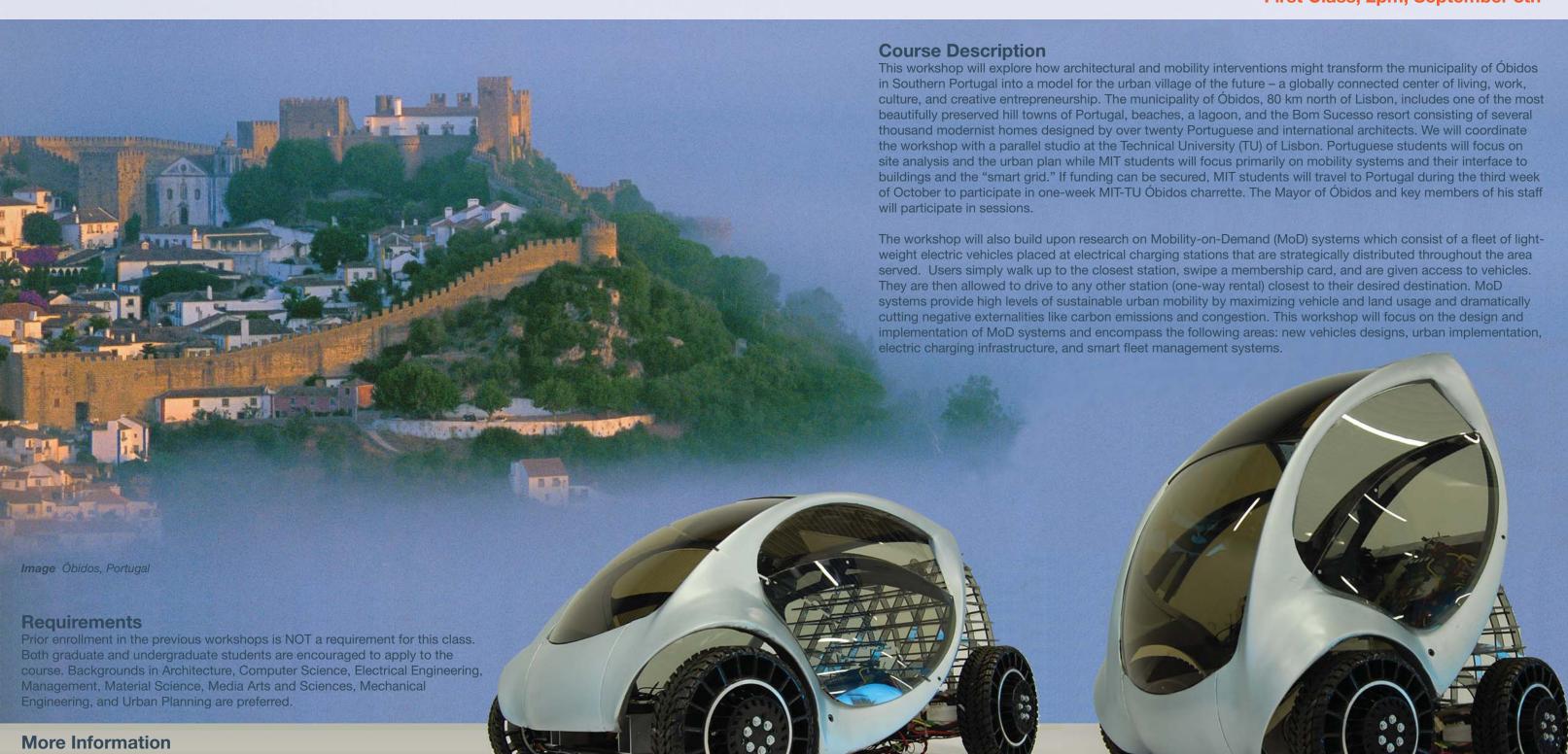# Mobility-on-Demand for the New Urban Village
MAS.552J / 4.557J

Instructors   Kent Larson, Ryan Chin
Contact   kll@mit.edu, rchin@media.mit.edu

Prereq: Permission of instructor
H (Fall)
(Units to be arranged)
Wednesday 2-5 pm
Room E14-493
First Class, 2pm, September 8th

Course Description

This workshop will explore how architectural and mobility interventions might transform the municipality of Óbidos in Southern Portugal into a model for the urban village of the future – a globally connected center of living, work, culture, and creative entrepreneurship. The municipality of Óbidos, 80 km north of Lisbon, includes one of the most beautifully preserved hill towns of Portugal, beaches, a lagoon, and the Bom Sucesso resort consisting of several thousand modernist homes designed by over twenty Portuguese and international architects. We will coordinate the workshop with a parallel studio at the Technical University (TU) of Lisbon. Portuguese students will focus on site analysis and the urban plan while MIT students will focus primarily on mobility systems and their interface to buildings and the "smart grid." If funding can be secured, MIT students will travel to Portugal during the third week of October to participate in one-week MIT-TU Óbidos charrette. The Mayor of Óbidos and key members of his staff will participate in sessions.

The workshop will also build upon research on Mobility-on-Demand (MoD) systems which consist of a fleet of light-weight electric vehicles placed at electrical charging stations that are strategically distributed throughout the area served. Users simply walk up to the closest station, swipe a membership card, and are given access to vehicles. They are then allowed to drive to any other station (one-way rental) closest to their desired destination. MoD systems provide high levels of sustainable urban mobility by maximizing vehicle and land usage and dramatically cutting negative externalities like carbon emissions and congestion. This workshop will focus on the design and implementation of MoD systems and encompass the following areas: new vehicles designs, urban implementation, electric charging infrastructure, and smart fleet management systems.

Image Óbidos, Portugal

Requirements

Prior enrollment in the previous workshops is NOT a requirement for this class. Both graduate and undergraduate students are encouraged to apply to the course. Backgrounds in Architecture, Computer Science, Electrical Engineering, Management, Material Science, Media Arts and Sciences, Mechanical Engineering, and Urban Planning are preferred.

More Information

http://cities.media.mit.edu/download/mas552J-Fall2010.pdf

MIT Course Collaborators

William Lark, Jr., Dimitris Papanikolaou, Raul-David "Retro" Poblano, Nicholas Pennycooke, and Praveen Subramani

CityCar Prototype: *William Lark, Jr., Nicholas Pennycooke, Raul-David "Retro" Poblano*

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Design Workshop: Mobility-On-Demand for the New Urban Village
Fall 2010

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Course Description

This workshop will explore how architectural and mobility interventions might transform the Municipality of Óbidos in Southern Portugal into a model for the urban village of the future – a globally connected center of living, work, culture, and creative entrepreneurship.

The Municipality of Óbidos, 80 km north of Lisbon, includes one of the most beautifully preserved hill towns of Portugal, beaches, a lagoon, and the Bom Sucesso resort consisting of several thousand modernist homes designed by over twenty Portuguese and international architects.

We will coordinate the workshop with a parallel studio at the Technical University (TU) of Lisbon. Portuguese students will focus on site analysis and the urban plan while MIT students will focus primarily on mobility systems and their interface to buildings and the "smart grid." If funding can be secured, MIT students will travel to Portugal during the third week of October to participate in one-week MIT-TU Óbidos charrette. The Mayor of Óbidos and key members of his staff will participate in sessions.

Primary focus of the Workshop

1. Urban Village (re)mix

Óbidos, at its prime, was largely a self-contained community. Work, learning, energy production, health care, and entertainment took place primarily within the town. With industrialization, many of these functions moved to centralized hospitals, factories, schools, and office buildings. As a result, beautiful historical places such as Óbidos declined, and

today are at risk of becoming tourist-oriented museum pieces rather than diverse, thriving communities.

The MIT-Obidos workshop will investigate how the old town, resort areas, technology park, lagoon, and other important locations can be integrated though strategic mobility and architectural interventions. We may consider the creation of a new "urban village" node adjacent to the old town, with an appropriately scaled and sensitive connection, to provide a mix of work places, housing, shopping, recreation, entertainment, and services that compliment that of the old center. The historical town, in turn, will provide the restaurants, cultural activities, hotels, and ambiance that support this new urban village.   This integrated whole will be designed to support, in an ad-hoc and agile manner, new ways of living, creative knowledge work, and entrepreneurship. It will have infrastructure and services to allow start-up companies to immediately "hit the ground running" and effortlessly expand or contract according to business opportunities. It will have responsive housing that can support a wide range of needs and activities, from virtual companies run from home to healthy and autonomous aging. It will incorporate a shared use, mobility-on-demand system that seamlessly links the places of Óbidos.

2. **Mobility-on-Demand**
Mobility-on-Demand (MoD) systems consist of a fleet of bicycles or lightweight electric vehicles placed at electrical charging stations that are strategically distributed throughout the area served. Users simply walk up to the closest station, swipe a membership card, and are given access to vehicles. They are then allowed to drive to any other station (one-way rental) closest to their desired destination. MoD systems provide high levels of sustainable urban mobility by maximizing vehicle and land usage and dramatically cutting negative externalities like carbon emissions and congestion. This workshop will focus on the design and implementation of MoD systems and encompass the following areas:

a) <u>New Vehicles</u> – Smart Cities at the MIT Media Lab has developed the CityCar with four innovative features: drive-by-wire control; a foldable chassis for small footprint when parked; front entry; and "robot wheels" with in-wheel electric motors, suspension, and steering.   A consortium of manufacturers is currently developing a full-scale working prototype of the CityCar in collaboration with MIT.   This workshop will explore additional vehicle types are that enabled by robot wheels and drive-by-wire.

b) <u>Urban Implementation</u> - Working with the Municipality of Óbidos we will examine MoD can be best implemented in a city of hills and narrow winding streets with a combination of 2-passenger CityCars, new vehicle types, electric scooters, and electric-assist bicycles. We will conduct urban analyses of the Municipality to determine ideal locations for charging stations, size the fleet, and create the optimal mix of vehicles for an eventual pilot program. The course will also examine the integration of MoD charging stations into the urban fabric including the space between buildings, parking lots, sidewalk, and street. We will explore the benefits of urban autonomous driving (e.g., self-parking and vehicle redistribution). We will investigate possibilities for creating a "community smart grid" for the local production, storage and use of electricity – including the use of electric vehicle batteries to supply energy to the grid during peak demand periods.

c) Electric Charging Infrastructure – Working with Media Lab sponsor, Schneider Electric, we will explore battery-to-battery rapid charging, contactless inductive charging (i.e., non-physical plug, non-contact power transfer), and new human machine interfaces for the entire drop-off and pick-up experience. We will also look at the benefits of Vehicle-to-Grid (V2G) capability of EVs to provide peak shaving, energy storage, and demand response to the utility and the power grid. Research will begin by analyzing the complete urban energy cycle starting from renewable distribute power generation to electrical power transmission to energy consumption by electric-drive vehicles and buildings.

d) Smart Fleet Management Systems – We will explore a logistics and dynamic pricing model for optimizing the supply and demand of vehicles and parking spaces for MoD. We will examine how system dynamics, urban sensing, GPS, and mobile phone applications can help with scheduling and routing.

Students will work in small teams throughout the semester lead by project leaders from Smart Cities. Projects will run the throughout the term with several joint design reviews with invited academic and industry guests. A detailed project description for the upcoming term will be discussed at the first class meeting for each project. Current project descriptions, visuals, and references can be found at: http://cities.media.mit.edu (under "Mobility" tab).

*Requirements
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Project Collaborators
Jose Duarte, Associate Professor at TU Lisbon Faculty of Architecture
Carlos Fernandez Isoird, Denokinn
Sergio Rinland, Epsilon Euskadi
Chris Borroni-Bird, General Motors
Phil London, Schneider Electric
Todd Snide, Schneider Electric

Key Texts
William J. Mitchell, Christopher Borroni-Bird and Lawrence Burns, *Reinventing the Automobile,* (MIT Press, January 2010).
William J. Mitchell, Me++ (MIT Press, 2004).

Term Schedule

Week	Dates	Wednesday
1	Sep. 8	First Class meeting, Introduction, Interviews (Demo prototypes)
2	Sep. 15	Form project teams, first assignment, Schneider Electric Intro
3	Sep 22	Group work time, Guest Lecture (Witricity TBC)
4	Sep 29	Group work time
5	Oct 6	Group work time, Sponsor week preparation
6	Oct 13	Media Lab sponsor week - Show Prototypes at open house
7	Week of Oct 18	Travel to Portugal (subject to sponsorship funding)
8	Oct 27	Mid-term Review (with invited guests)
9	Nov 3	Schneider Electric guest lecture
10	Nov 10	Work time
11	Nov 17	Work time
12	Nov 24	Thanksgiving week
13	Dec 1	Work time
14	Dec 8	Final Class Meeting (prep for final review)
15	Dec 15	Final Review (with invited guests)
16	Dec 22	Start of Winter Break
		End of fall term