סביבות חכמות

This research-oriented course aims at teaching novel approaches for designing, modeling, and simulating dynamic human-building interactions in tech-enhanced environments. Students will learn how to simulate the operations of an intelligent building that is aware of ongoing activities, predicts the future needs of the building occupants, and provides proactive recommendations of optimal resource allocation (such as spaces, people, and equipment) to meet the dynamic needs of the inhabitants.

Some of the fundamental questions that the students will ask in the course are:

* What are the benefits of creating technologically augmented environments?
* What are the psychological, social, and environmental implications of creating such hybrids?
* How can buildings anticipate and proactively meet the needs of their inhabitants?
* What are the criteria to measure successful responsive environments?

The questions will be tackled through theoretical and practical frameworks developed at the Intelligent Place Laboratory, including the computational modeling of human-building interactions using video game engine technologies such as Unity 3D.

## General Information

**Course format and hours:** 3 hours combining lectures, workshops, and project reviews

**Students:** The course is open to 30 graduate students and excellent upper-level undergraduate students.

## Teaching Approach

Classes will combine lectures, in-class project reviews, and workshops on computational methods for modeling and simulation human-building interactions. The exercises will be conducted in small teams and will include the following tasks:

* **Ezercise 1**: Collect data about human behavior in a selected site and define a desired building-human interaction to optimize a selected spatial, social, or operational metrics.
* **Ezercise 2:** Model human behavior patterns in the selected site.
* **Ezercise 3**: Model the intelligent response of the built environment in reaction to – or anticipation of – the identified behaviors.
* **Ezercise 4:** Simulate and refine the proposed human-building interaction to demonstrate the benefits of an intelligent environment in addressing the dynamic needs of their inhabitants.

## Learning Outcomes

Upon successful completion of the course, students will be able to:

* Analyze human-building interactions in existing environments
* Critically assess opportunities to improve the interactions between people and the built environment by defining key metrics for improvement
* Use computational methods for modeling human-building interactions using video game engines, such as Unity 3D.
* Predict and analyze alternative building response strategies to improve space utilization, people experience, and organizational efficiency

## Requirements

| Percentage of final Grade | Details | Requirements |
| --- | --- | --- |
| 80% | Mandatory | Excercise Submission |
| 10% | Mandatory | Attendance |
| 10% | Active | Participation |

## Exercizes

| Percentage of final Grade | Submission | Details | Type |
| --- | --- | --- | --- |
| 15% | Class 4 | Behavior Mapping | Exercise 1 |
| 15% | Class 7 | Human Behavior Narrative Modeling | Exercise 2 |
| 15% | Class 10 | Intelligent Building Response Modeling | Exercise 3 |
| 35% | End of the Semester | Final Human-Building Interaction | Exercise 4 |

## Timetable

| Topic | Class # |
| --- | --- |
| Lecture: Introduction to Smart Environments  Workshop: Mapping Human Behavior in Built Environments | 1 |
| Lecture: Modeling Human Behavior Narratives  Workshop: Introduction to Unity 3D & Visual Scripting | 2 |
| Exercise 1: In-class review | 3 |
| Exercise 1: Presentation & Discussion (Behavior Mapping) | 4 |
| Lecture (International Guest): Interaction Narratives for Responsive Architecture  Workshop: Modeling Human Behavior Narratives in Unity 3D | 5 |
| Exercise 2: In-class review | 6 |
| Exercise 2: Presentation & Discussion (Human Behavior Narrative Modeling) | 7 |
| Lecture (International Guest): What drives human behavior in buildings?  Workshop: Modeling Intelligent Environments in Unity 3D | 8 |
| Exercise 3: In-class review | 9 |
| Exercise 3: Presentation & Discussion (Intelligent Building Response Modeling) | 10 |
| Exercise 4: In-class review | 11 |
| Exercise 4: In-class review | 12 |
| Exercise 4: In-class review | 13 |
| Exercise 4: Final Presentation (Final Human-Building Interaction) | July 6, 2022 |

## Required Software & Equipment

* Software:
  + Unity 3D for modeling human-building interactions
  + Rhinoceros 3D for modeling built environments
* Equipment: Personal laptop