

# Morphology of Adaptive Systems

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**Purpose:** Many aspects of our physical environment are becoming integrated with information systems, a phenomenon that has been referred to as the “The Internet of Things (IoT).” In Architecture, IoT can be understood as a seamless combination of data-driven design, data analysis, and adaptive systems. Adaptive Systems Studio, composed of 17 graduate architecture and 14 undergraduate interior design students led by one architecture and interior design faculty, seeks to develop new methods of architectural design by using information-based toolsets.

By showcasing the application of data-driven design strategies within a pedagogical context, students’ projects present innovations made possible by our current technological environment, remark the concepts of contemporary data-driven design, and show how they can be used in a pedagogical framework to nurture student’s creative capacities within an ever-changing technology-driven era. They also demonstrate how architectural design can accompany data systems to connect the two worlds of information and physical design.

**Method:** Students began with exploring scholarly resources on computational methods for information analysis, and responsive systems operations. Such instruction was

combined with conventional architectural education regarding the materials behavior, fabrication, assembly, and so forth. Then, students made use of cutting-edge architectural software such as Grasshopper, Firefly, Dynamo, Python scripting, augmented reality, and physical computing environment using Arduino microcontrollers. Students in this interdisciplinary studio designed a new university visitor’s center with the principles of sustainability, adaptive systems, and data-driven design. Student’s research investigated possibilities of designing amid the IoT, big-data and, informational–physical interconnectivity.

**Process:** In the first step of the studio, students conducted a literature review and presented their understanding in the form of infographics to better understand contemporary outlooks on the IoT. For this project, the topics to focus on were “IoT Smart City”, “IoT Smart Building”, “IoT Smart Space Applications” as well as “IoT Building Automation Applications”.

In the second step, experiment with physical spaces, students were observing how built environments can gradually morph based on various environmental and user inputs. They designed and fabricated a kinetic mechanism to explore adaptive systems while investigating how naturally occurring adaptive systems can serve as inspiration for programmable built

environments. Focusing on material behavior and physical transformation, students were to observe how their designs would change over time and to incorporate activators such as heat, humidity, light, and motion. Computational modeling along with digital fabrication technologies was also used in this stage. Besides, they collaborated with the members of the university’s Robotics Club to learn about the microcontrollers’ use.

In the last step, using the knowledge gained, they produced designs for a new university visitor’s center implementing data-based scenarios and adaptive system ideas to successfully integrate the informational and physical environments. While acknowledging building as a component of a smart city, they incorporated elements that could respond to data (from Internet-based media, city

and transportation data, and “machine-to-machine” data from sensors and related devices). This studio encouraged designers to reinterpret architecture within the IoT to evaluate data-driven design potentials to create smarter future that is responsive to both human and environment needs.

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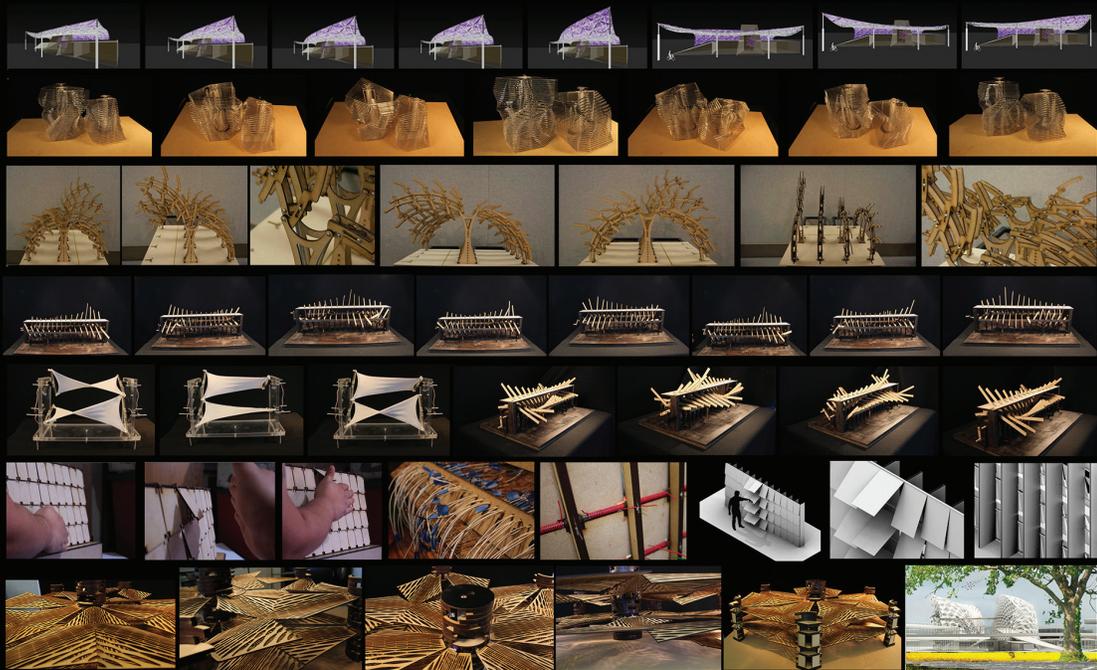
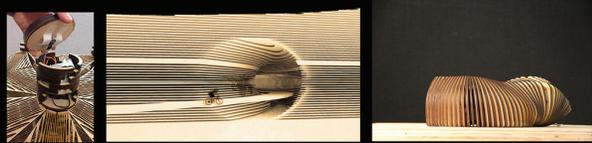


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