COMMUNITY PERFORMATIVE PARAMETRIC DESIGN

Objective of Research

The study will result in a demonstration installation of street light with kinetic response to environmental and user inputs. We will investigate feasibility and possibilities of using the installation to enhance wellbeing of residents. The study involves Pines Village, the first neighborhood in the City of Pembroke Pines. The design of the installation will address important issues such as the lack of street lights, crime prevention and neighborhood aesthetics. The study is based on a combination of performance simulation and parametric modeling techniques. They are advanced skills sought after in the profession.

Background

The City of Pembroke Pines conducted a resident survey resulting in a list of their concerns that need to be addressed. The lack of street lights, crime and neighborhood aesthetics are top priorities. Developing street lights is an appropriate and economical way to enhance the activity taking place on the streets on Pembroke Pines during the night. During the day, the lights can function as sculptural elements that are aesthetically pleasing and hopefully provide neighborhood identity. There is an opportunity to explore interactive and adaptive design as well as the utilization of renewable energy.

Research questions include:

- Will this proposal positively affect the surroundings and who will benefit from the project?
- Can street lights take different form and provide additional functions through adaptive design?
- Can street lights be used as a means of communicating certain information with residents?
- How will people engage or interact with the design?
- Is there a particular “local” style incorporated to the design of this project?

Methodology

Parametric modeling techniques will be employed as a generative and kinetic response study tool. Generated designs will be scrutinized using simulation tools to look at their performance. The project also includes technological feasibility study of lighting and renewable energy technology.

The criteria used to evaluate designs are based on Crime Prevention Through Environmental Design (CPTED) principles. It is clear that the CPTED strategies must be integrated into the design. Applicable design strategies include:

- Natural Surveillance – Visual Connection: increase visibility of a property. This is achieved by proper placement of windows, lighting, and landscaping. Users of a space

can be observed by all who observe. In a public place, this is much more effective than camera surveillance, because intruders don't know who is watching them.

- Natural Access Control – Spatial definition: these can be seen as security points where doors, shrubs, fences, and gates prevent access. Public space should be located centrally near main circulation paths.
- Territorial Reinforcement- sense of ownership: this distinguishes between public and private space, and can provide clear direction of circulation. This can be done by utilizing landscape design, where pavers suggest movement, and planters define space.

- Maintenance – continuing the use of a project: The health, safety, and welfare of occupants in existing structures. Establish minimum requirements and standards to keep the project alive and potentially improve over time rather than deteriorate.

Anticipated Outcomes

We expect to create a prototype model, which will be tested using simulation software to examine its lighting performance and adaptive design aspect. Information on construction will be provided to the City of Pembroke Pines to support their funding proposal focusing on street light installation. This project provides an opportunity for us to apply academic research to solve important issues in community. Moreover, collaboration with the partnering manufacturers and the local architectural firm will strengthen relationship which will benefit the School's future academic activities.

COMMUNITY PERFORMATIVE PARAMETRIC DESIGN

Timeline

October 2014
Background Research and Grant application.

November – December 2014
Technical Research: Identify technologies and perform feasibility study

January 2015
Preliminary design: digital modelling, simulation and producing physical 3D mock-ups. The City of Pembroke Pines, manufacturers and a local mentoring architectural firm will be involved with the project through sharing their feedback and expertise.

February 2015
Preliminary design: and testing prototypical designs

Presentation 1: Increase scale of mock-ups and display results.

March 2015
Final Presentation 2: Based on digital model(s) improvements and scale increase of physical mock-ups.

April 2015
Select best model as solution and create prototype for performance testing. Produce necessary means of visual presentation, including graphic board (approx. 36”x72”), and PowerPoint slideshow including verbal communication. Final results will be presented to the City of Pembroke Pines

COMMUNITY PERFORMATIVE PARAMETRIC DESIGN

Budget and Budget Justification

The project is divided into 3 phases:

1) Preliminary Design
   The budget will be used to purchase materials for physical models of experimental designs. Equipment for kinetic mechanisms such as sensors, actuators, software and a control platform will be provided by the School. The costs of material are listed below:

Acrylic	$80.00
Medium density fiberboard	$40.00
Subtotal	**$120.00**

2) Prototypical Design Testing and Presentation
   In this phase, selected design will be developed as a prototypical design. It will be constructed, and kinetic mechanisms will be incorporated into the design. The functional design will be presented to the City of Pembroke Pines. The construction requires materials with costs listed below:

Metal sheet	$550.00
Fasteners	$50.00
Shape memory alloy	$130.00
Servo motor	$150.00
Subtotal	**$880.00**

COMMUNITY PERFORMATIVE PARAMETRIC DESIGN

References

- Fabio Gramazio, Matthias Kohler, Silke Langenberg (Editors), Fabricate: Negotiating Design and Making (gta Publishers, 2014)
- Kas Oosterhuis, Hyperbody: First Decade of Interactive Architecture (Santa Monica: Ram Distribution, 2012)
- Kjell Anderson, Design Energy Simulation for Architects: Guide to 3D Graphics (New York: Routledge, 2014)
- Mark Burry, Scripting Cultures: Architectural Design and Programming (London: Architectural Design, 2011)
- Marroquin, H., Thitisawat, M., and Vermisso, E. (2013), Performative Parametric Design of Radiation Responsive Screens, Proceedings of Architectural Research Center Consortium 2013 Architectural Research Conference, March 27-30, 2013, Charlotte, North Carolina.
- Paul Nicholas, Designing Material Materialising Design (Toronto: Riverside Architectural Press, 2013)
- Philip Beesley, Omar Khan, Michael Stacey (Editors), ACADIA 2013: Adaptive Architecture (Toronto: Riverside Architectural Press, 2013)
- Rachel Armstrong, Simone Ferracina (Editors), Unconventional Computing: Design Methods for Adaptive Architecture (Toronto: Riverside Architectural Press, 2013)
- Robert Woodbury, Elements of Parametric Design (Oxon: Rouledge, 2010)
- Russell Fortmeyer, and Charles Linn, Kinetic Architecture:: Designs for Active Envelopes (Victoria: The Images Publishing Group Pty Ltd., 2014)
- Terri Peters, and Brady Peters, Inside Smartgeometry: Expanding the Architectural Possibilities of Computational Design (London: Architectural Design, 2013)
- Wassim Jabi, Brian Johnson and Robert Woodbury, Parametric Design for Architecture (London: Laurence King Publishing, 2013)
- Vermisso, E., Thitisawat, M., and Feldsberg, M. (2013), An Irregular Discretization Process for Climate-Responsive Facades, Proceedings of Sustainable Intelligent Manufacturing International Conference, Lisbon, Portugal.

COMMUNITY PERFORMATIVE PARAMETRIC DESIGN

Justification on Group Member Contribution

<student> will act as a Project Manager responsible for coordination and communication with the City of Pembroke Pines to achieve timely delivery of the project. In addition, he will assist in design, production of drawings, physical and digital models, simulations, and presentations.

<student> will act as a Design Manager managing digital files, and organizing fabrication procedures. He will communicate with manufacturers and a local mentoring architectural firm. He will also assist in design, production of drawings, physical models, simulations, and presentations.