Tethering the Sustainable Design Community

Submitted: The Small Research and Collaborative Works Program
Institute for the Study of Liberal Arts
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Project Description:
To **establish** and ultimately promote and sustain a social fabric that embraces a crowd-sourced approach to the generation and curation of quality assured data related to the far-reaching building sector sustainability challenge.

Background and Motivation:
Buildings are the largest consumer of domestic energy and resources. In 2006, buildings accounted for 40 percent of domestic primary energy consumption and 72 percent of U. S. electricity consumption, a figure that is projected to increase to 75 percent by 2025[1], regardless of advances in non-traditional energy sources.

In order to transform the way that buildings and infrastructure are designed today and to ensure a more sustainable built environment – and future – we need a transformative approach, one that leverages the full body of data, knowledge, and expertise that is literally embedded in the built world. We need tools and infrastructures for data and knowledge acquisition, discovery and sharing between communities so collective knowledge, experience and more importantly data, can be pooled and accessed widely. By leveraging the collective knowledge of the wider professional community, the challenges of realizing truly sustainable, energy efficient design can be addressed in an unprecedented fashion.

Our ongoing research recognizes that buildings – and the teams of people who design and operate them – are significant repositories of building performance information and design data, but there currently exist substantial barriers to accessing this information and making it useful in a sustainable design process. We have identified target communities that have facets of data relative to the sustainability problem that as of yet have had no motivation or means to share data with the wider community. By gathering – and tethering – a diverse Community of Experts, we will begin **building a data community** and, in a related effort, the cyber-infrastructure to utilize it (the data). This cyber-infrastructure will ultimately act as a scaffold on which to grow and sustain the community of users.

Tethering the Sustainable Design Community:

The initial phase of building the virtual community/ network research will focus on creating and assessing the appropriate mechanisms to enable data contribution and use within a particular community. We will undertake this work in the context of two workshops to be held in July and September of this year which will convene a seed Community of Experts from across the building industry and the country. The first workshop is focused on bringing the Community together to discuss key themes in building sector impact

[1] "U. S. Department of Energy and Annual Energy Review 2007" (2008): DOE/EIA-0384(2007).

and the heterogeneous data tied to designing, constructing, and operating buildings and infrastructure, policy, energy supply and building material supply chains.

A central aspect of this work will be to study the unique technology adoption life cycle (TALC) of this particular community. Truly discontinuous innovations require the end users to dramatically change their past behavior, using the motivation of gaining equally dramatic new benefits, in this case the access to a powerful data repository, or by generating sufficient community momentum that it is "unacceptable" not to participate[2]. Thus the adoption strategy must acknowledge this and explore the necessary motivations to attract participants. Our approach to attract, retain and motivate the participation of our crowd builds upon our past experiences in crowd-sourcing technical tasks[3], including data collection[4] and the identification of the role of instrumental and moral incentives[5] using a seed and scale approach that allows progressive development of our crowd policies and subsequent, related (cyber-infrastructure) construction.

The second workshop (September) will focus on creating infrastructure for data interoperability between heterogeneous data sets collected from the seed Community and the web. Particularly, the use of ontologies or ontology patterns to specify a shared conceptualization of different domain specific terminology between architects, manufactures, builders, public policy experts and the energy production domain. This will occur within the context of a regional Geospatial Vocabulary Workshop (GeoVoCamp) with members of the Spatial Ontologies Community of Practice.

This multi-institutional and multidisciplinary effort brings together experts in Data and CyberInfrastructure (CRC–Nabrzyski and Vardeman) with experts on building community sourced data (iCeNSA and Sociology – Hachen and Engineering Kijewski-Correa) and domain experts in School of Architecture (Buccellato). Our work will also include external collaborators in the area of geospatial data ontologies (leaders of the Spatial Ontology Community of Experts and the U. S. Geospatial Intelligence Foundation), knowledge synthesis, and sustainable Design and community development.

Budget Request:
$2,500

Funding to supplement funding ($20,000) received from ND's Center for Sustainable Energy to organize, conduct, and facilitate travel and accommodations for sixteen (16) key external collaborators and ten ND seed Community members including PI Hachen for two (2) two-day Community building workshops.

The first workshop will be hosted by the School of Architecture in the School's studio space in the Santa Fe building in downtown Chicago. The location of the second workshop is being coordinated with the annual fall Geospatial Vocabulary Camp (VoCamp) held by the Spatial Ontology Community of Experts (SOCoP), this year at the National Science Foundation in Arlington, Virginia. Alternately, the Center for Research Computing at ND will host the second workshop.

[2] Moore, G. A. Inside the Tornado: Strategies for Developing, Leveraging, and Surviving Hypergrowth Markets. Harper Business Press (2009).
[3] Kijewski-Correa, T. "Open Sourcing the Design of Civil Infrastructure (OSD-CI): a Paradigm Shift" (2011): Proceedings of Structures Congress, Las Vegas, NV.
[4] Zhai, Z., Hachen, D., Kijewski-Correa, T., Shen, F., and Madey, G. "Citizen Engineering: Methods for 'Crowdsourcing' Highly Trustworthy Results" (2012): 3406–3415. doi:10.1109/HICSS.2012.151.
[5] Hachen, D. and Zertcher, Z. "Online Work Motivation: an Experiment with Instrumental and Moral Incentives"(2011), American Socioological Association Meeting, Las Vegas, NV.

Related Sources of Funding:

1. Center for Sustainable Energy; Sustainable Energy Initiative Round 6 - Track 1
   Proposal: Center for Sustainable Design Research - ND
   Award: $19,867 ($29,800 requested)
   To organize, conduct, and facilitate travel and accommodations for key external collaborators (16) and additional seed Community members (10) for (2) two-day workshops related to this proposal.
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2. School of Architecture
   Cost-share: $5,933 (on the above proposal)
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