Modular-based Green Design Studio for Sustainable Building

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Introduction

Green Building Entity (GBE)
Multiscale modular-based strategy for green building design

Green Building Database (GBD)
Database for green building entities with forward-step and backward-step assessment of performance

Green Design Studio (GDS)
Building performance assessment tool for green building design based on

- *Physics-based* model
- *Reduced-order* model
- *Data-driven* model.

Green Building Database

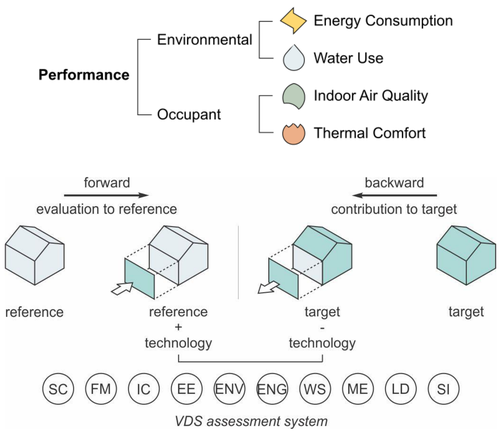
GBEs of existing green buildings are collected and classified based on 10 design factors from **Virtual Design Studio.**
Forward-step and **backward-step** performance assessments, as well as **scalability analysis** for each GBE are conducted.

Performance Potential $P_{c,i} = \frac{E_{ref+\Sigma-i} - E_{ref+\Sigma}}{E_{ref+\Sigma}} = \frac{E_i'}{E_{ref+\Sigma}}$

Performance Contribute $P_{c,i} = \frac{E_{ref+\Sigma-i} - E_{ref+\Sigma}}{E_{ref+\Sigma}} = \frac{E_i'}{E_{ref+\Sigma}}$

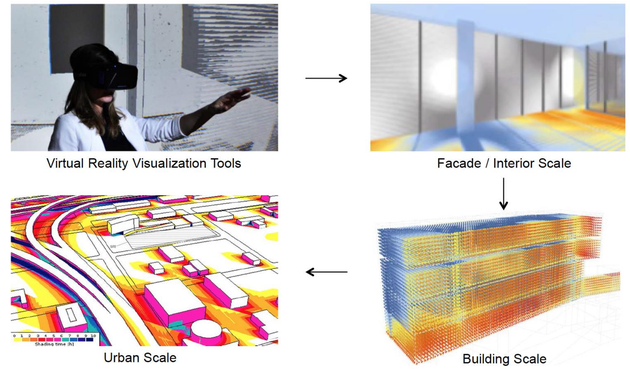
Synergistic effect $S_i = P_{c,i}/P_{p,i}$

Scaling coefficient $\beta_i = P_{c,i}'/P_{c,i}$



Visualization

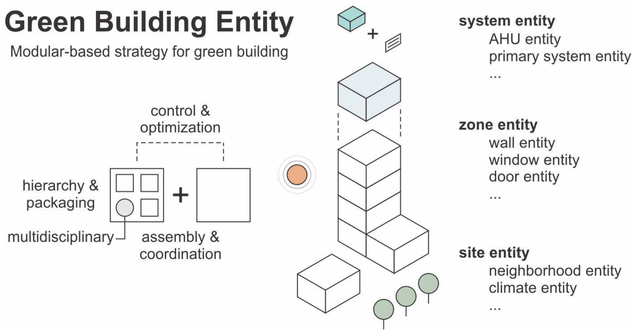
Virtual Reality (VR) technique is used to visualize during design and post-processing stages.



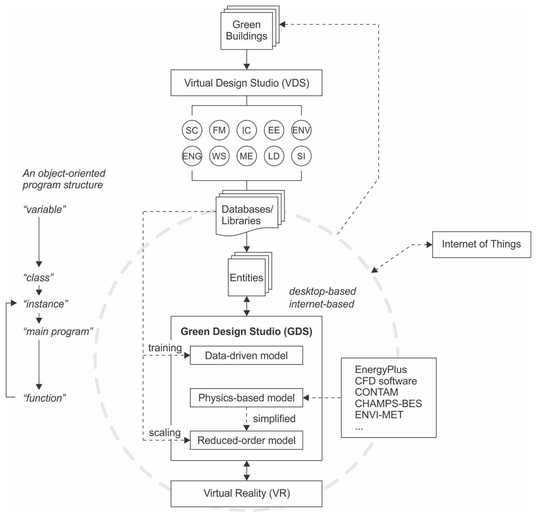
Green Building Entity

Green building systems or spaces in multiple scales (system, building or urban scales) with performance embodied.

- **system entities**
- **zone entities**
- **site entities**



Green Design Studio



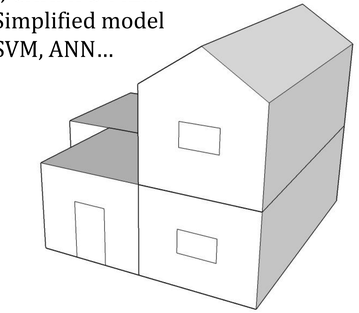
Green Design Studio (GDS) is developed upon the systematic analysis to GBD, and adopt a **modular-based strategy** using GBEs presented in database to enable **intuitive and fast performance assessment for green building design**.

Algorithm

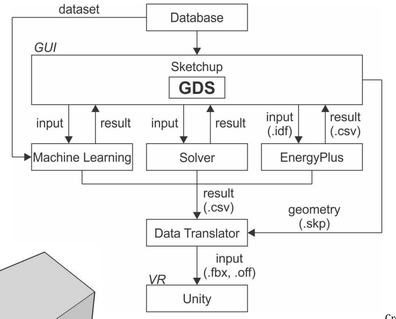
- **Physics-based model**: E+, CHAMPS-MZ…
- **reduce-ordered model**: Simplified model
- **Data-driven model**: LM, SVM, ANN…

Feature

- **Multiscale**
- **Multidisciplinary**
- **Modular-based**
- **Fast feedback**
- **User friendly**



Implementation



GDS is implemented as a plugin in **Sketchup**, and takes Sketchup as the GUI.