CityOptimiser: Our CV-based Urban Planning Proposal

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Lancaster University, May 2024

<-- Our LOGO

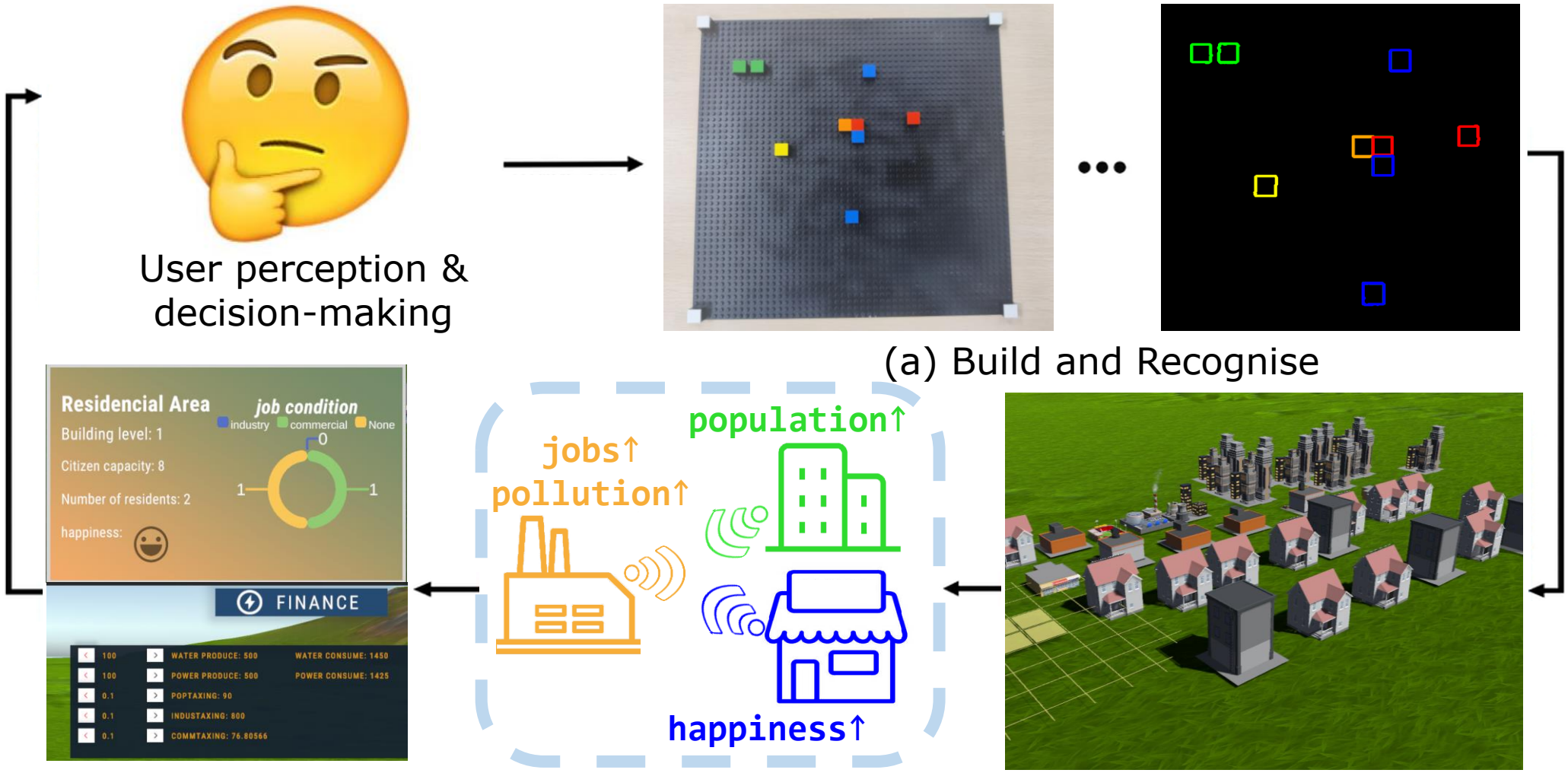
Background

- Mass Urbanisation Challenges
- Traditional Urban Design:
  Lack of social dynamics, efficiency…
- **CityScope** Project @MIT Media Lab
  Participatory design
  Interactive, real-time simulation
  Consensus building
  Open and extensible architecture

Motivation

- Target users: high school / college students
  - Age: 15~22
  - Receiving urban planning courses
- Goal: a light-weight, easy-to-deploy framework
  - Focus on realization of visual recognition
  - Abstract based on realistic urban planning theory
- Feature: **Co-op user friendly / CSCW-oriented**

CityOptimiser Overview



Districts

Provide entertaining activities, improve happiness

Entertainment Area

Improve city's technology, can increase production capacity

Technology Area

Satisfy the investment for resident lives, adjust tax index

Finance

Necessary condition for an increase in urban population

Residential Area

Regulate the city, add some buffs to the city

Policy

Allows residents to purchase goods, provides tax revenue

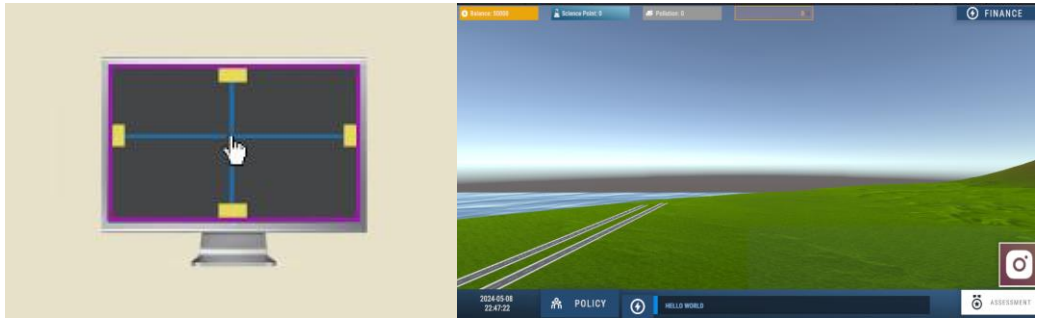
Commercial Area

Produce essential goods for citizens, but with pollution

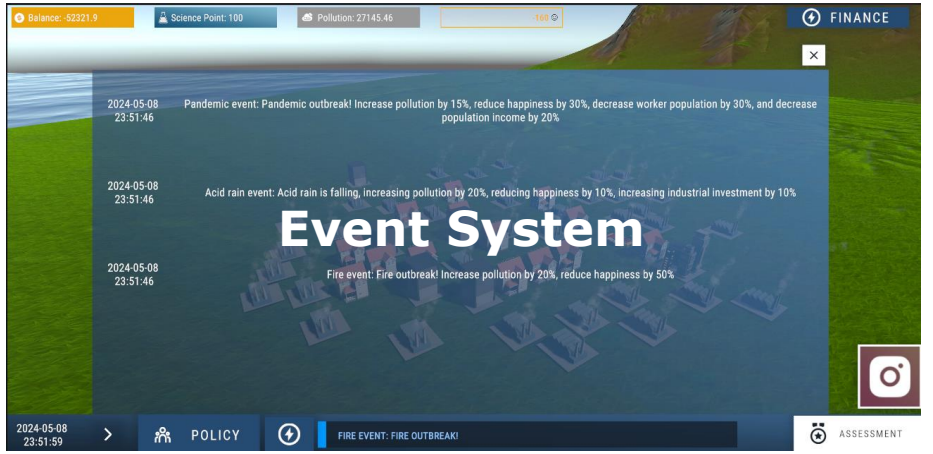
Industrial Area

HCI Details

- Sound effect
  - Button sound feedback
- Fitts' Law
  - Navigation bar on the edges



- Ergonomics & Uni. Design
  - Multi-language support
  - TUI to facilitate discussion
- Memory & Reasoning



Persona & Scenario

- Lenna, an undergrad
  - Majoring in urban planning
  - Interest in video games
  - Lack of programming skill
  - Trying to understand “concise layout”
  - Sufficient communication skill

- Scenario:

  “During a lab session for the urban planning course, Lenna and her partners are asked to form-ulate ideas about how to derive or assess a concise urban design. They need to satisfy a collection of ***tasks*** *ontlined by CityOptimiser, including maximise tax income while contain industrial pollution in an acceptable level. A* ***finite amount*** *of blocks are provided to represent different types of districts in their design…”*

Our development workflow

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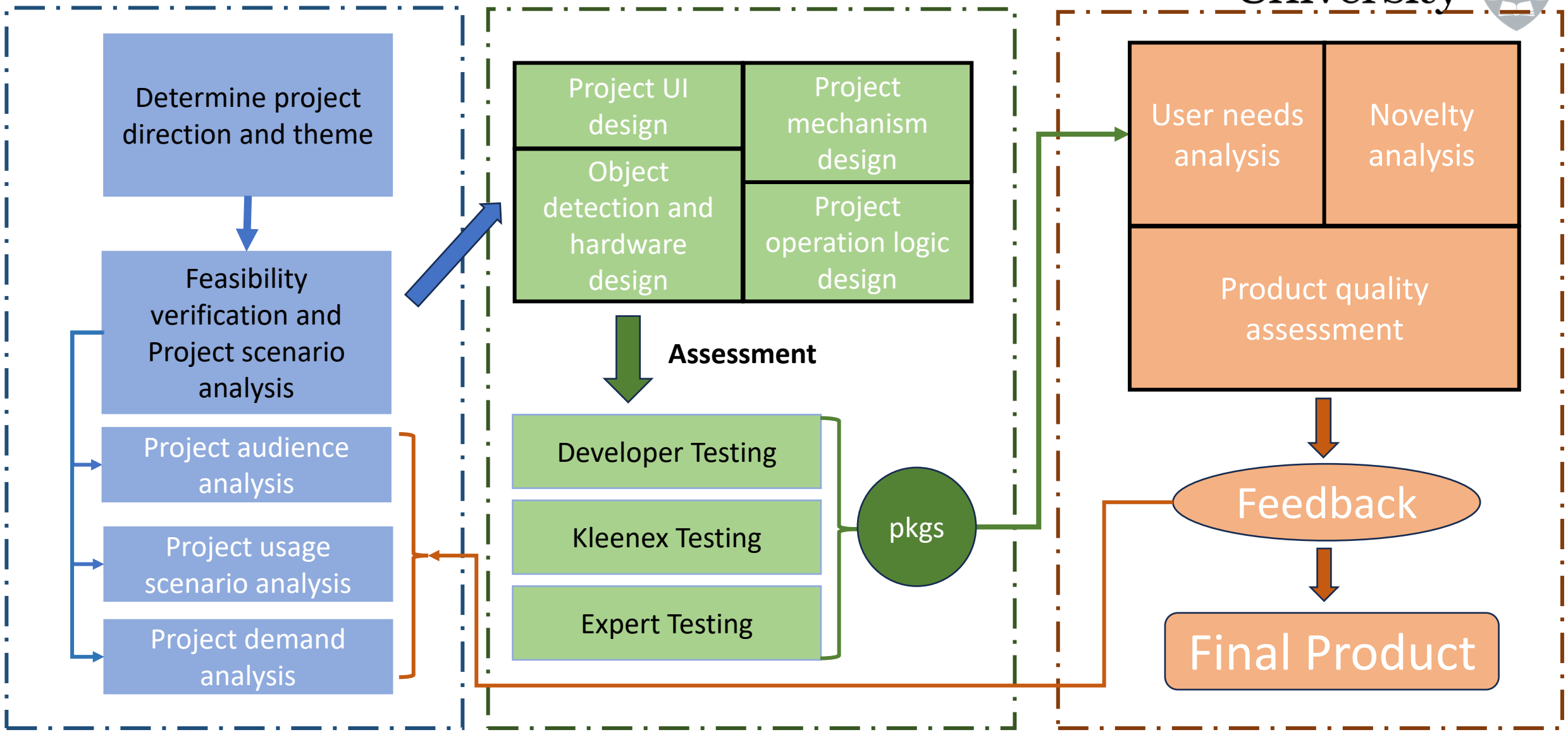


Evaluation

- Hypothesis 1: our use of TUI facilitates UX.
  - IV: whether to use TUI (yes/no)
  - DV: user satisfactory score
  - Method: Student's *t*-test
- Hypothesis 2: larger user groups prefer our design.
  - IV: group size (discrete)
  - DV: efficiency = tasks per time
  - Method: ANOVA

Analysis of t-test Results

Analysis Item	Items	Sample Size	Mean	Std. Devi.	Mean diff	95% CI	t	df	p
UX	1.0	20	4.15	0.93	0.95	0.384 ~ 1.516	3.395	38.000	0.002**
	2.0	20	3.20	0.83					
	Total	40	3.67	1.00					

*** p<0.05 ** p<0.01**

Analysis of Variance Results

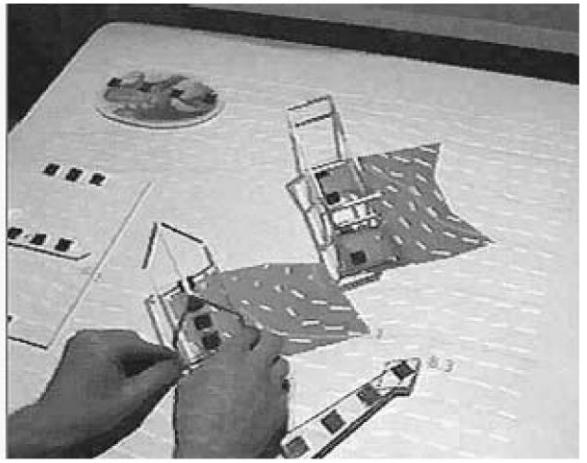
Analysis Item	Items	Sample Size	Mean	Std. Deviation	F	p
Teamwork efficiency	1.0	6	4.00	0.89	1.005	0.416
	2.0	6	4.17	0.75		
	3.0	4	4.50	0.58		
	4.0	4	4.75	0.50		
	Total	20	4.30	0.73		

*** p<0.05 ** p<0.01**

Future Work

- Tangible policy UI with RFID sensors
  Inspired by various board games
  (Plague Inc., Civilization…)

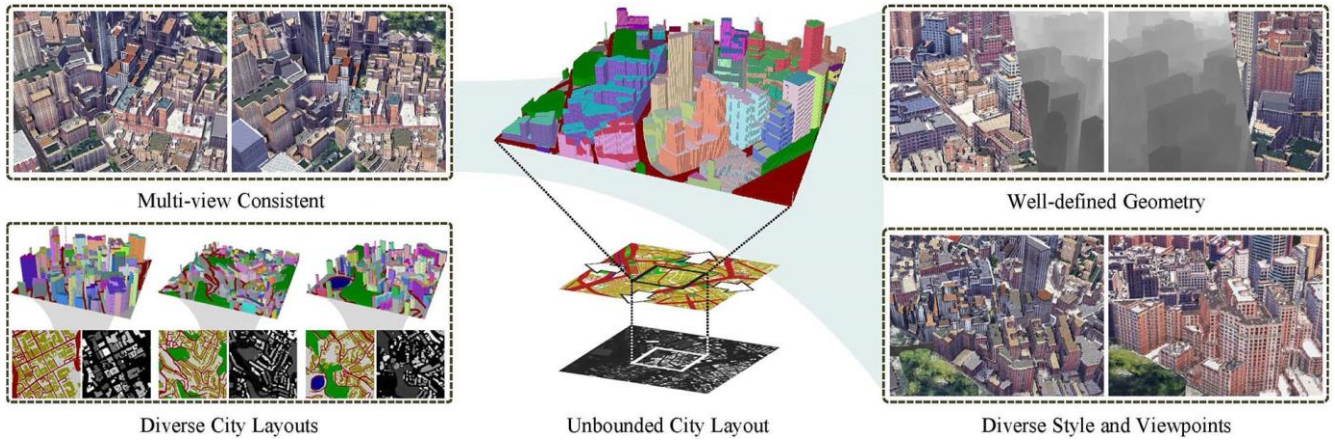
- Colour range-tolerant CV model
  - Shadow, extra light exposure resilient
  - User DIY districts
  - Deep learning as a solution?



- Luminous Planning Table @Media Lab

Research Interest

- AIGC: CityDreamer @NTU S-Lab



- How to encode semantic relations for different buildings? (industrial sectors, research institutions, etc.)

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- Ariel Noyman. [n. d.]. CityScope: An Urban Modeling and Simulation Platform. MIT Media Lab. https://www.media.mit.edu/publications/cityscope/ Accessed: 2023-12-07.
- Haozhe Xie, Zhaoxi Chen, Fangzhou Hong, and Ziwei Liu. 2024. CityDreamer: Compositional Generative Model of Unbounded 3D Cities. In CVPR.
- John Underkoffler and Hiroshi Ishii. 1999. Urp: a luminous-tangible workbench for urban planning and design (CHI '99). Association for Computing Machinery, New York, NY, USA, 386–393. https://doi.org/10.1145/302979.303114

Team X = Xplore

Proudly Presents

Tribute to our kind mentor, **Dr. Anna Li**

<-- Still our LOGO ;)