09/01/ - 09/25/2024

Zenith Woods

ENVIRONMENTAL DATA-DRIVEN DESIGN SYS

Environmental datasets such as temperature variations were analyzed and connected to AI-assisted design systems to explore adaptive architectural skins. Visualizations function as interfaces between climate data, AI-generated iterations, and design decisions, highlighting data-driven environmental responsiveness.

Theme |

Environmental Data / AI Systems / Decision Visualization

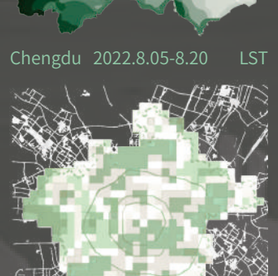
DATA
INVESTIGATION

Surface temperature in Chengdu |

Colour/°C

- 40-42
- 38-40
- 36-38
- 34-36
- 32-34
- 29-32
- 24-29
- 19-24
- 13-18
- 07-13
- 00-07

Chengdu 2022.8.05-8.20 LST



Chengdu 2022.8.05-8.20 LST

Use LST data from the USGS website

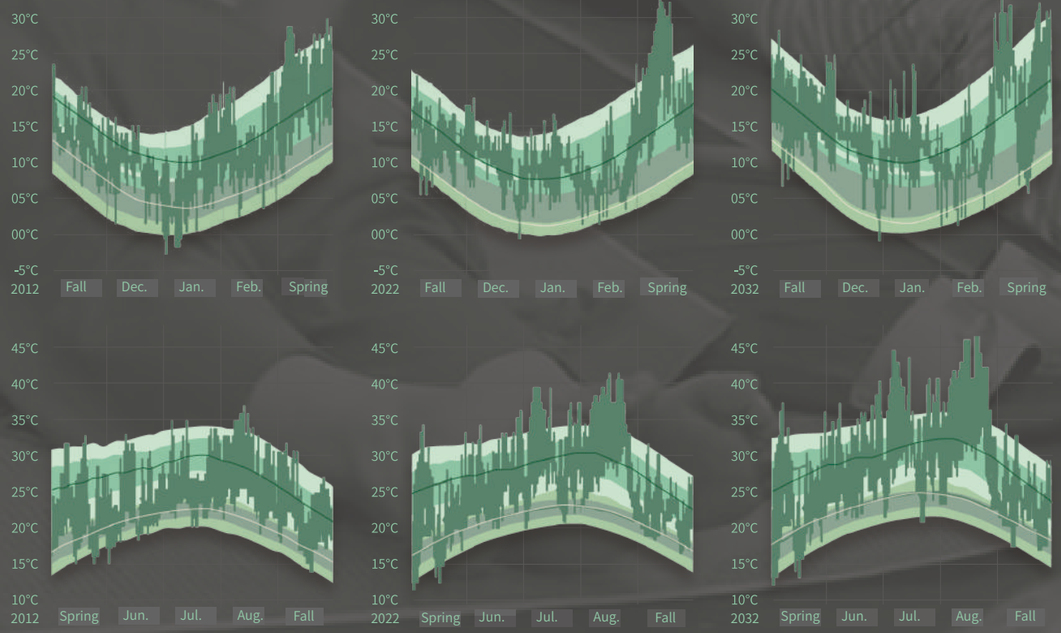
Calculate the data average using QGIS software

Serve as the average surface temperature under extreme temperatures

Summary and Prediction |

The temperature changes in Chengdu
show an obvious overall warming trend.
Locally, there is a trend of even lower low - temperatures, with a two - level decrease.
In the future, it may experience more frequent extreme weather events
and an extended high - temperature season.

2012-2022-2032 Temperature changes in winter and summer |



24-hour high temperature | 25-75% | 24-hour low temperature | 25-75%

The daily temperature range | Average daily high temperature | Average daily low temperature

The temperature data is sourced from weatherspark

chatGPT predicts the possibility of future climate based on 10-year changes

Artificial intelligence is applied to the conception of the climate crisis

ALGORITHMIC
LOGIC

Y : An n × 1 observation vector
X : An n × (k + i1n)dependevnat riable matrix
β : A (k + 1) × 1 coefficient vector
I : The value of Moran's Index
n : Total number of samples [Number of spatial units]
W : Sum of all weights in the adjacency matrix
w_{ij} : The value of the adjacency relationship between spatial unit i and spatial unit j
e_i 、e_j : Residuals of spatial units i and j
$\bar{e}$: Mean value of residuals

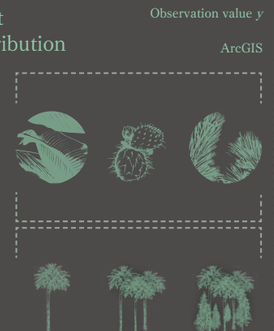
Plant Characteristics

These natural phenomena and materials, through experimentation and application, can effectively deal with the extreme climate differences in the same area.

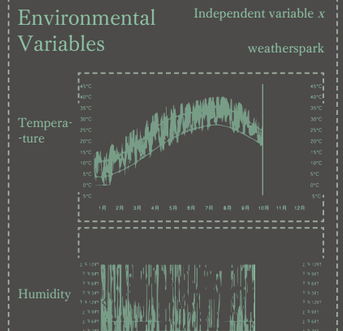
This helps buildings intelligently adjust and adapt when extreme heat and extreme cold 42 co - exist.

Data Preparation

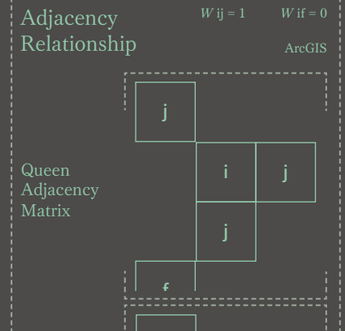
Plant Distribution — Observation value y — ArcGIS



Environmental Variables — Independent variable x — weatherspark



Adjacency Relationship — W ij = 1 — W if = 0 — ArcGIS



Ecological Analysis Intervention in Plant - dynamic Building Skin

Establish the objective function formula

$$SEE = \sum_{i=1}^{n} e_i^2 = \sum_{i=1}^{n} (y_i - y_i)^2 = (Y - X\beta)^T (Y - X\beta)$$

Minimize the sum of squared errors --calculate by β

$$\beta = (X^T X)^{-1} X^T Y$$

equation of linear regression --calculate by predicted value of y

$$\hat{y}_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik}$$

calculate by e

$$e_i = y_i - \hat{y}_i$$

Calculate the Moran Index value

$$I = n/W \cdot \left[\sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij} (e_i - \bar{e})(e_j - \bar{e}) \right] / \left[\sum_{i=1}^{n} (e_i - \bar{e})^2 \right]$$

Evaluate the spatial autocorrelation of plant coverage

- $I = 0$ → Improve greening layout
- $I < 0$ → Increase ecological connectivity; Targeted greening design; Ecological buffer zone design
- $I > 0$ → Strengthening of aggregation areas; Centralized management and maintenance; Enhance ecological benefits

Design of plant - dynamic building skin → Lagrange multiplier test (LM) → Is it significant?

- None
- Lagged → Sustainable land management (SLM)
- Deviated → Optimize future plans
- All → Scanning electron microscope (SEM)

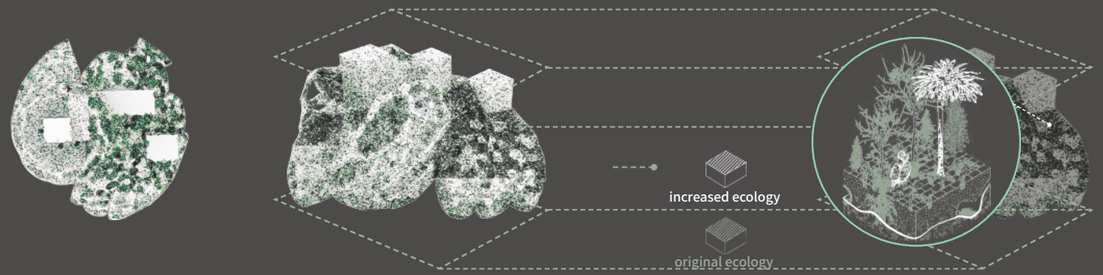
Monitoring feedback

Construction of Dynamic Building Facades

Adaptive Layout of Plants

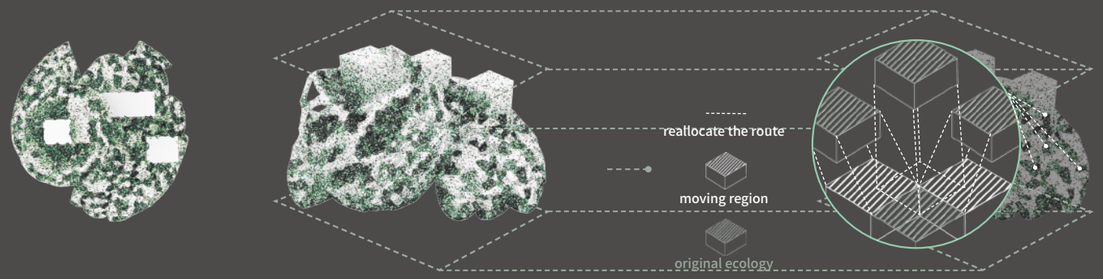
I > 0 Positive Autocorrelation: Regional Aggregation

Increase ecological functions



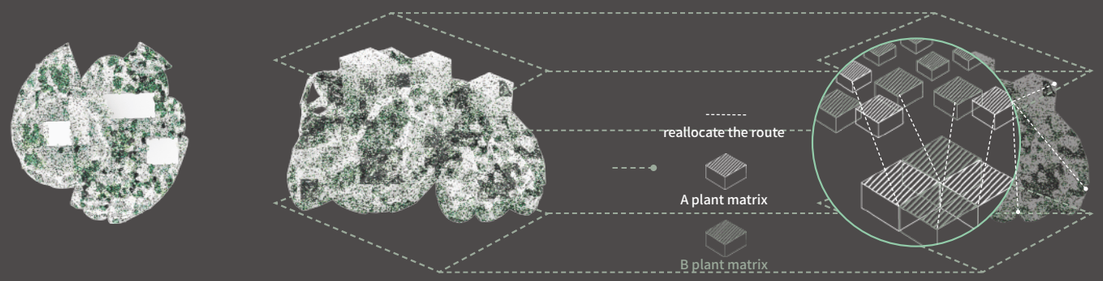
I < 0 Negative Autocorrelation: Alternating Distribution

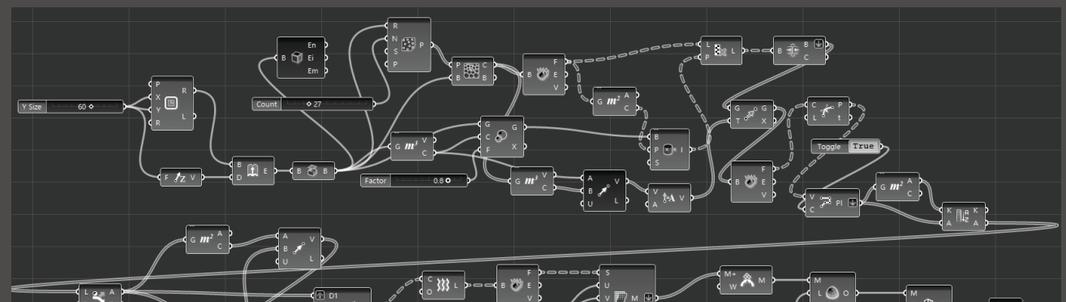
Reduce ecological islands. Implement targeted ecological allocation



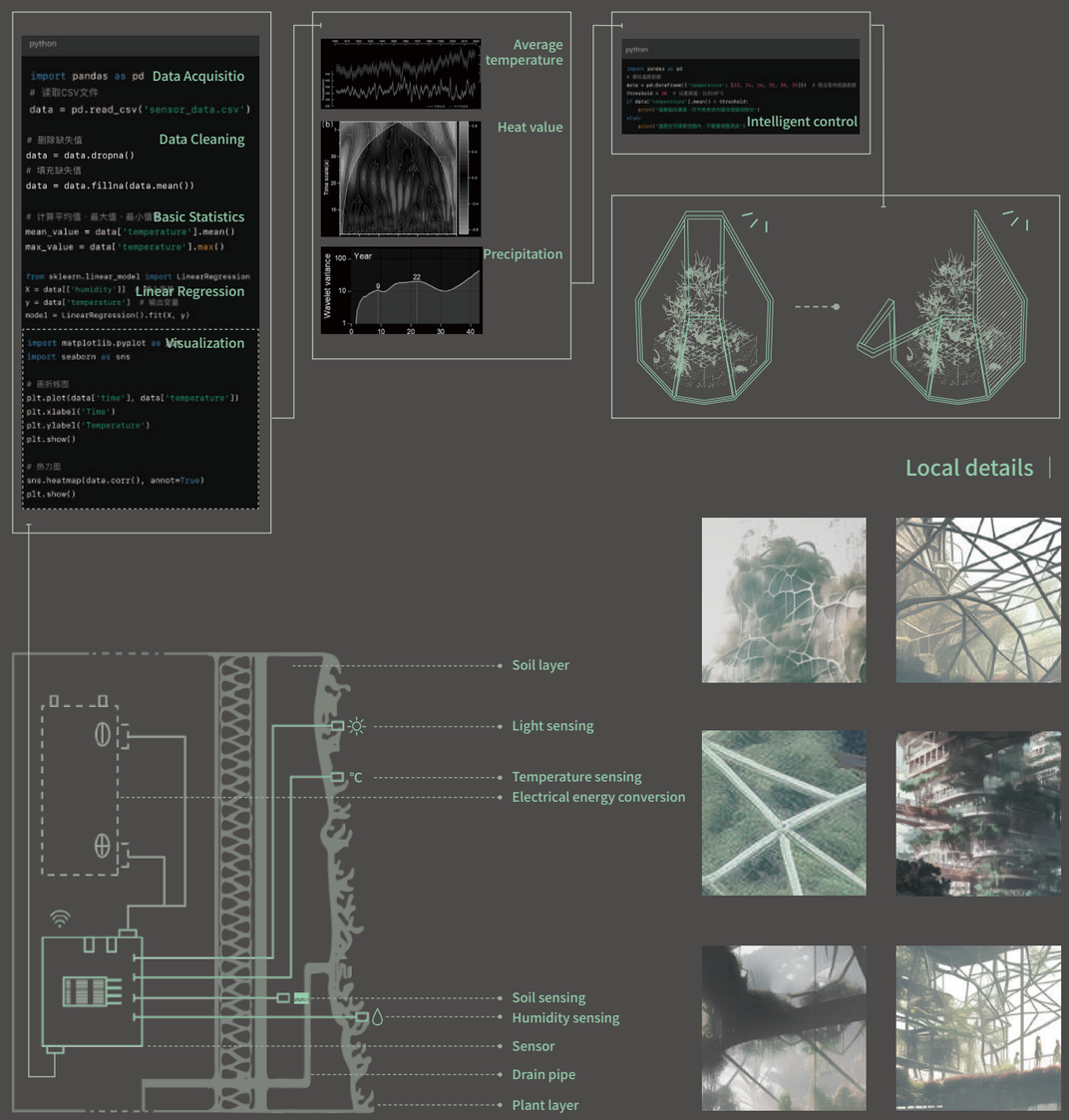
I = 0 No Autocorrelation: Random Distribution

Re - evaluate. Re - layout





Dynamic Regulation and Flow



Local details

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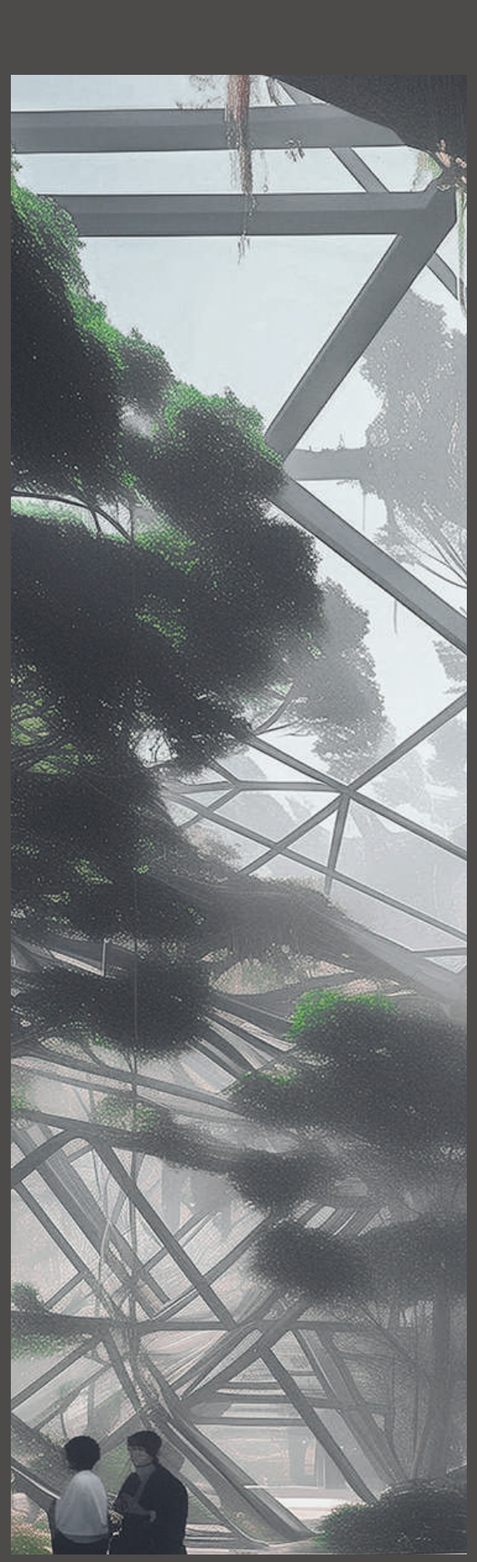

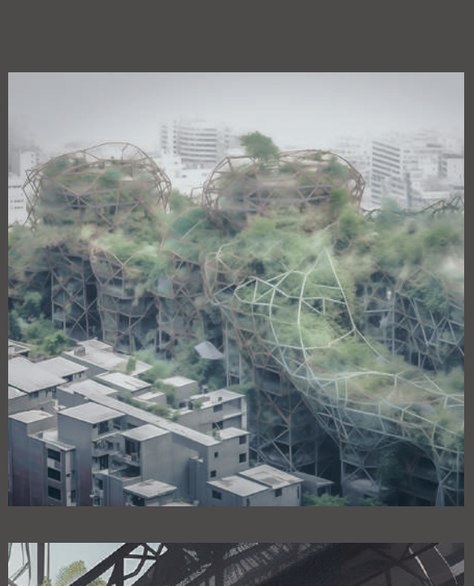

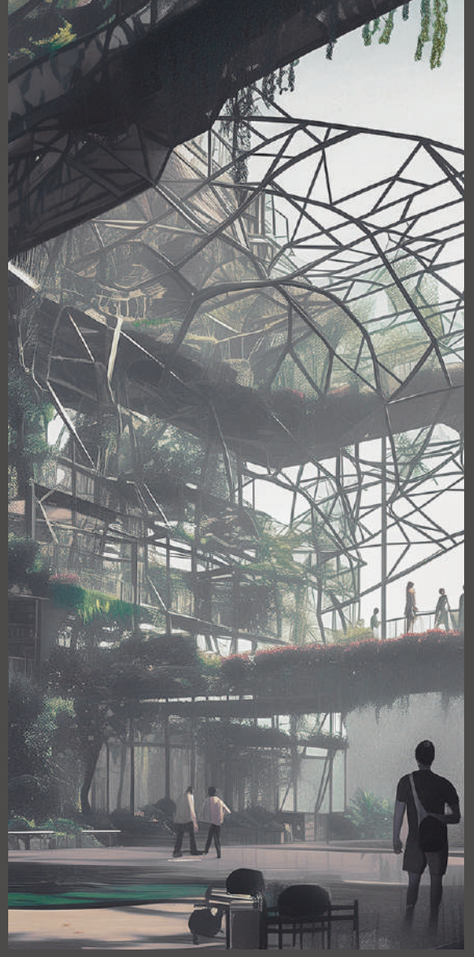

Artificial intelligence is applied to the conception of the climate crisis