URBAN MICRO-CLIMATE MANAGEMENT SYSTEM for Low-Carbon and Eco-City

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What is Urban Micro-Climate?
1. What is Urban Micro-Clim ate?

1) Climate near on the Ground → under 60m Height

2) Temperature, Wind Condition and Pollutant Diffusion according to Topography, Land Cover and Local Surroundings
2. Wind Corridor as Urban Micro-Climate
UMcMS Concept and GUI
(Urban Micro-Climate Management System)
1. System Concept

1) 3D Virtual View Component with Macro- and Micro-scale Analysis Model & Thermal-Analysis Model

- Land Cover
- Topography
- Building Height
- Building Material
- Weather Conditions
- Energy Data
  - Units of Land
  - Units of Building
- Three Dimensional Virtual View Component
- MACRO-MODEL
- Micro-Scale Analysis
- MACRO-MODEL
- Three Dimensional Virtual View Component
- MICRO-MODEL
- Thermal-Analysis MODEL
- Digital Map
- Macro-Scale Analysis
- Cold-Air Production Analysis
- Cold-Air Flowing Analysis
  - Wind Speed Analysis
- Cold-Air Flowing Analysis
- Pollution Distribution Analysis
- Temperature Distribution Analysis
- CO₂ Distribution Analysis
  - NO₂ Distribution Analysis
  - SO₂ Distribution Analysis
- Planning-Method for Improvement of Sustainability
- Sustainable Urban Planning
  - under Consideration of Low-Carbon and Eco-City
- Urban Micro-Climate Management System
- Green-House Gas Analysis
- Micro-Scale Analysis
- Thermal Analysis
- Sustainable Urban Planning
  - under Consideration of Low-Carbon and Eco-City

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Earth Cover

Topography

Cold-Cold Air Flowing Analysis

Wind Speed Analysis

Cold-Cold Air Production Analysis

Micro Micro-Model

Energy Data

Units of Land

Units of Building

Sustainable Urban Planning

under Consideration of Low-Carbon and Eco-City

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Digital Map

Green-House Gas Analysis

Urban Micro-Climate Management System

Sustainable Urban Planning

under Consideration of Low-Carbon and Eco-City
2. System GUI

FILE
- New
- Open
- Save
- Terrain Open
- Terrain Save
- Print
- Quit

DATA
- Creating
  - Terrain
  - Satellite
  - Land Cover
  - Building
- Extraction
  - Terrain
  - Land Cover
  - Building

ANALYSIS
- Wind
  - Wind Flow
    - Diffusion
  - Wind Flow
    - Diffusion
- Thermo
  - Temperature
  - Amenity
- GHG
  - CO₂
  - NO₂
  - SO₂

DISPLAY
- Land
  - Land Cover
  - Biotop
- Wind
  - Wind Flow
    - Diffusion
  - Wind Flow
    - Diffusion
- Thermo
  - Temperature
  - Amenity
- GHG
  - CO₂
  - NO₂
  - SO₂
System Workflow & Pilot Study
1. System Workflow

1) Cold Wind Flow Analysis (Macro Scale)
   - Case Area: Jung-Gu and Nam-Gu in Daegu
1. System Workflow

2) Cold Wind Flow Analysis (Micro Scale)
   - Case Area: High-rise APT District in Nam-Gu, Daegu
1. System Workflow

3) Thermal Analysis (Micro Scale)
   • Case Area: High-rise APT District in Nam-Gu, Daegu
2. Pilot Study with UMCMS

1) Evaluate Micro-Climate according to Planning Factors
   ▪ Study Area: Nam-Gu in Gwangju City, Korea

   ▪ MicroCLIMATE Change according to Planning Factors (1)

   ▪ Macro Simulation

   ▪ Micro Simulation

   ▪ Streamlet-Street
     - Ave. Wind 0.12 m/s ↑
     - Ave. Temp. 0.3°C ↓

   ▪ Traditional Theme-Street
     - Ave. Wind 0.6 m/s ↑
     - Ave. Temp. 0.4°C ↓

   ▪ KEYS MAP

   ▪ City Area: 501.34 km²
   ▪ Population: 1,433,640
2. Pilot Study with UMcMS

1) Evaluate Micro-Climate according to Planning Factors

   - Study Area: Nam-Gu in Gwangju City, Korea

   ▼ Micro-Climate Change according to Planning Factors (2)

   ![Central Square](image1)

   ![Traditional Parking lot](image2)

   **Macro Simulation**

   **Micro Simulation**

   **Wind (m/s)**

<table>
<thead>
<tr>
<th>Location</th>
<th>Mean Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Square</td>
<td>1.2 m/s</td>
</tr>
<tr>
<td>Traditional Parking lot</td>
<td>1.0 m/s</td>
</tr>
</tbody>
</table>

   **Temp. (°C)**

<table>
<thead>
<tr>
<th>Location</th>
<th>Mean Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Square</td>
<td>26.8°C</td>
</tr>
<tr>
<td>Traditional Parking lot</td>
<td>26.6°C</td>
</tr>
</tbody>
</table>

   - Ave. Wind 0.26 m/s ↑
   - Ave. Temp. 1.0°C ↓
   - Ave. Wind 0.18 m/s ↑
   - Ave. Temp. 0.3°C ↓
2. Pilot Study with UMcMS

1) Evaluate Micro-Climate according to Planning Factors
   - Study Area: Nam-Gu in Gwangju City, Korea

   **Micro-Climate Change according to Planning Factors**
   - **Waterfront Park**
     - Ave. Wind: 0.99 m/s ↑
     - Ave. Temp: 0.7°C ↓

     | Wind (m/s) | Temp.(°C) |
     |------------|-----------|
     | 0.36m/s    | 26.9°C    |

   - **Pocket Park**
     - Ave. Wind: 0.77 m/s ↑
     - Ave. Temp: 0.7°C ↓

     | Wind (m/s) | Temp.(°C) |
     |------------|-----------|
     | 0.34m/s    | 27.0°C    |
Conclusion for Low Carbon and Eco-City
Conclusion

Urban Micro-Climate Management for Low Carbon and Eco-City

- Land Cover
  ① More natural Cover, less artificial Cover

- Building
  ① Material
  ② Type and Allocation

- Networking
  ① Green Network
  ② Blue Network
  ③ White Network
Conclusion

Future Planning for System Improvement
- Functions Supplement
  ① GHG(CO$_2$, CH$_4$) Analysis and Display Function
  ② Quantitative Comparison Function
- Reliability Improvement
- System Stabilization

System Application
- For Using for Low-Carbon Green Growth Policy
- For Creating of Environmental Atlas for Climate Change Adaption
- For Improvement of Citizens Well-being
- For Sustainability of Urban Development
Thank you for your attention!