

Smart Eco Path Finder for Mobile GIS Users

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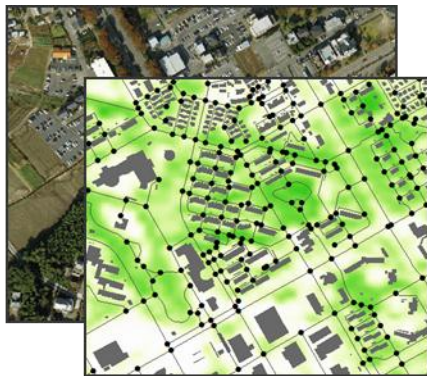
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SMART ECOPATH FINDER

OBJECTIVE

To develop **an integrated methodology** (Remote Sensing, GIS and Spatial Web Technology) to model **urban green space walkability**, which enables local residents to make spatial decision while their walking on the way.



ALOS-AVNR2
Building Footprints
Road Network
Public Facilities



Spatial Web Technology
GIS + Internet Technology
Urban Green Space Walkability Model



Local residents
decision making
Find eco-friendly living place
Find shortest or greenest paths



SMART ECOPATH FINDER

URBAN GREEN SPACES (Improve Mental Health)

URBAN GREEN SPACES

Improve Mental Health

Studies on the relationship between nature and health

*Residents of neighborhoods with abundant **green spaces** tended, on average, to enjoy **better general health** (Maas et al., 2006)*

*More often one visits **green areas**, the less often one reports **sickness from stress** (Grahn and Stigsdotter, 2003)*

*Neighborhood greenness was more strongly associated with **mental health** than it was with physical health (Sugiyama, 2008)*



SMART ECOPATH FINDER

URBAN GREEN SPACES (Social Interaction and Cohesion)

URBAN GREEN SPACES

Social Interaction and Cohesion

*Green spaces (especially parks) play important roles in **social interactions and cohesion***

- *Children can play and build friendship*
- *People can meet and talk each other*
- *Do green exercises together*

Other Benefits

- *Reduce cooling and heating demands*
- *Improve air quality*
- *Reduce storm water runoff*
- *Enrichment of urban biodiversity*
- *Reduce urban heat island effect*
- *More*



SMART ECOPATH FINDER

ECO-CITY

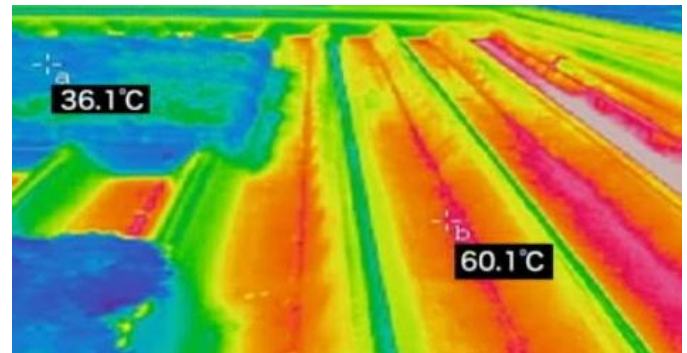
ECO-CITY

Many parts of the world, new or current urban planning activities are shifting to focus on eco-city (*Dizdaroglu et. al., 2009*)

Eco-yane (Roof)

In Japan, roof top greening by Daiwa Lease aims:

- To reduce room temperature
- To cut-off heating demands



Source: NHK Eco Channel, 2008

Drop 2C inside the room temperature

2C

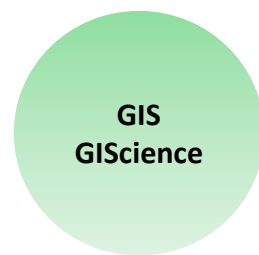


SMART ECOPATH FINDER

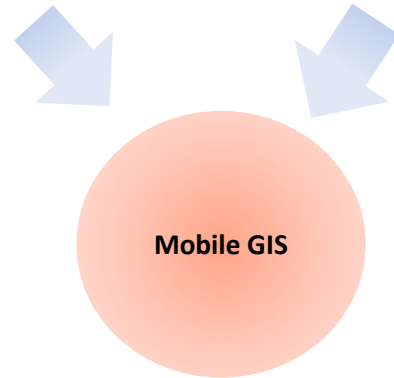
SPATIAL WEB TECHNOLOGY

GIS → GIScience → GIST (Geographical Information Science and Technology)

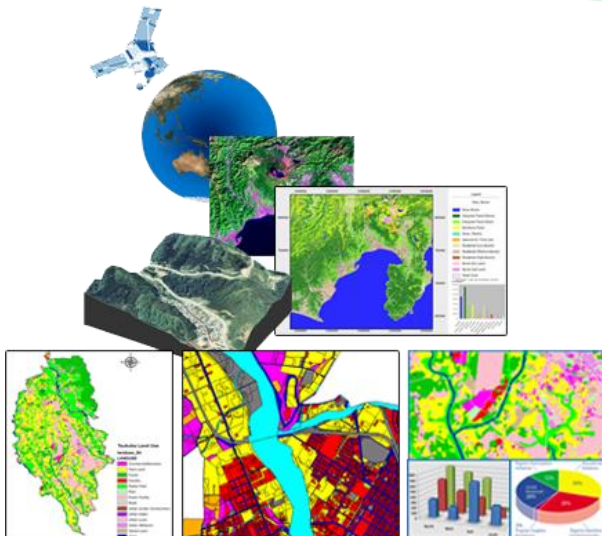
Provide theory and concept
Enhance spatial analysis
Improve spatial modeling
Adequate decision making



Emergence of Internet
Development of communication technology
ISDN > ADSL > Wi-Fi access
Development of Hardware
Desktop > Laptop > Netbook > Smartphone



GIS is more accessible
GIS goes professional to public
Part of our daily lives
Finding closet facility, driving routes, ...
Geospatially enabled society



SMART ECOPATH FINDER

SMART ECO-PATH FINDER

Focused on:

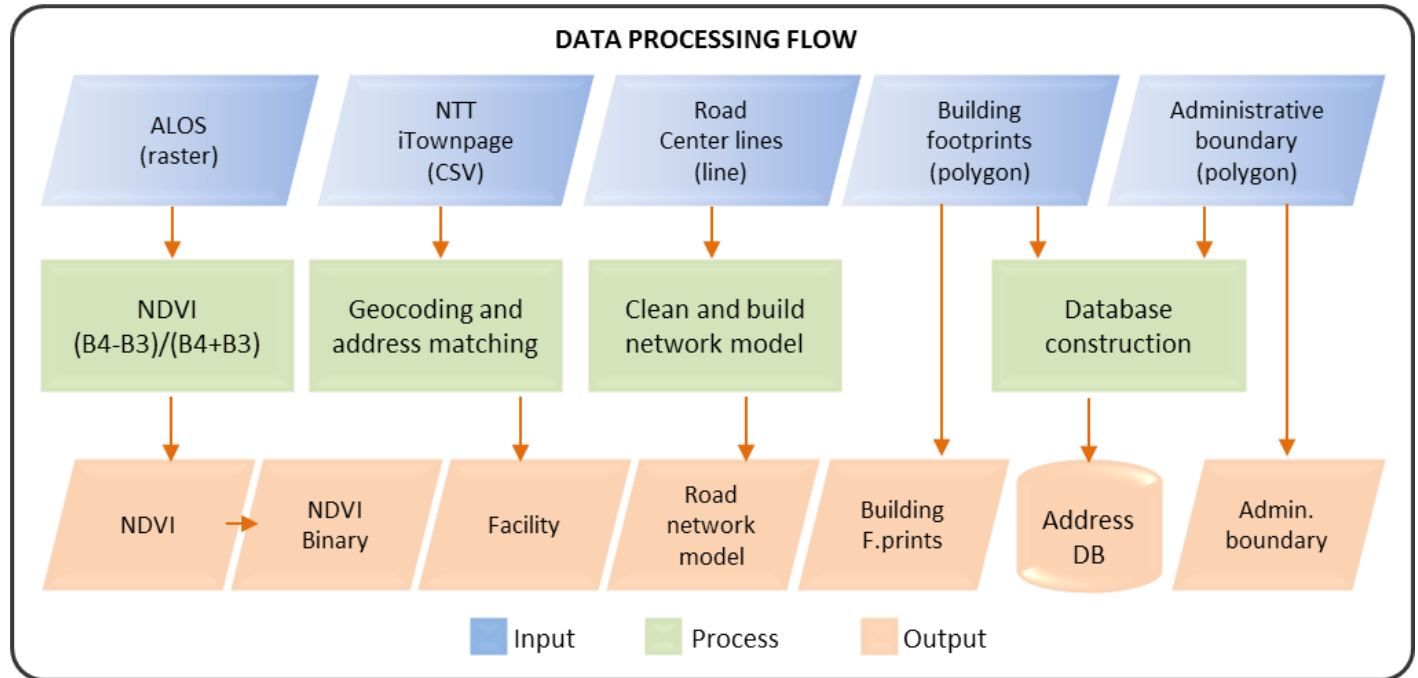
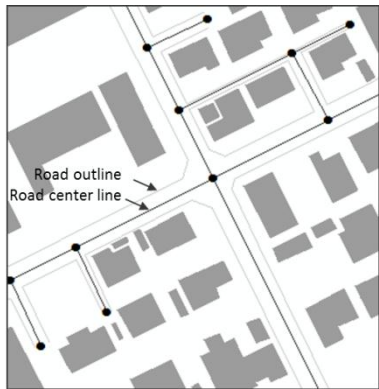
- How to utilize urban green spaces with GIST (GIScience & Technology)?*
- How to evaluate neighborhood environmental quality with GIST?*
- How to find shortest paths for shopping with GIST?*
- How to find greenest paths for walking with GIST?*



LIST OF DATA and DATA PROCESSING FLOW

List of Data

- ALOS-AVNR2
- Building Footprint
- Administrative Boundary
- Road Center Line
- NTT iTownpage



NDVI binary image: Greenness score calculation

iTownpage: Allocation of facility point

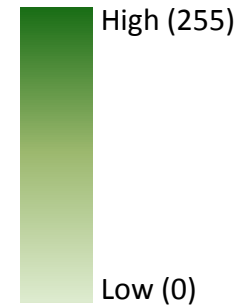
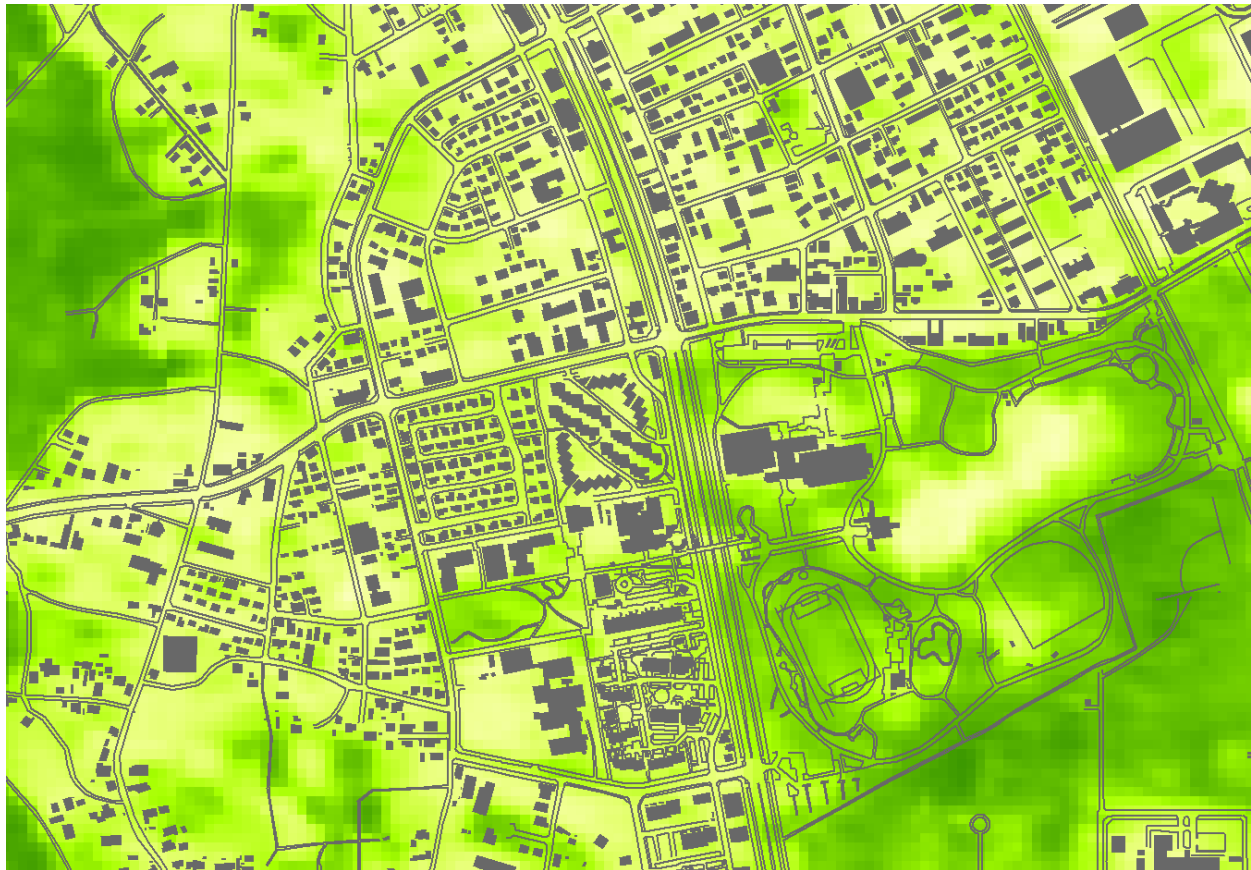
Road center line: Find shortest and greenest path

Building Footprint + Admin. Boundary: Construct address database



SMART ECOPATH FINDER

NDVI INTENSITY IMAGE



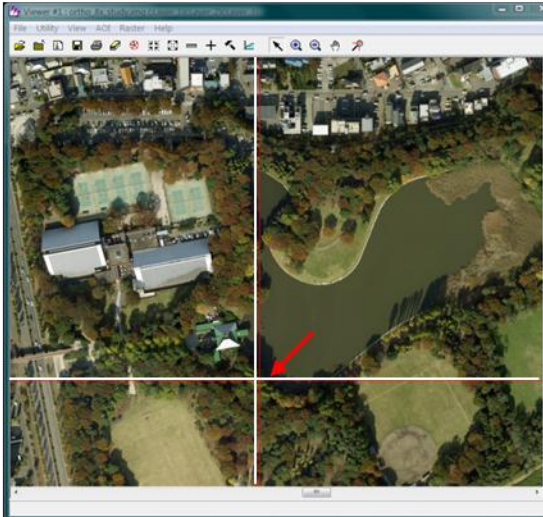
NDVI intensity image (DN = 0 – 255) at 10m spatial resolution



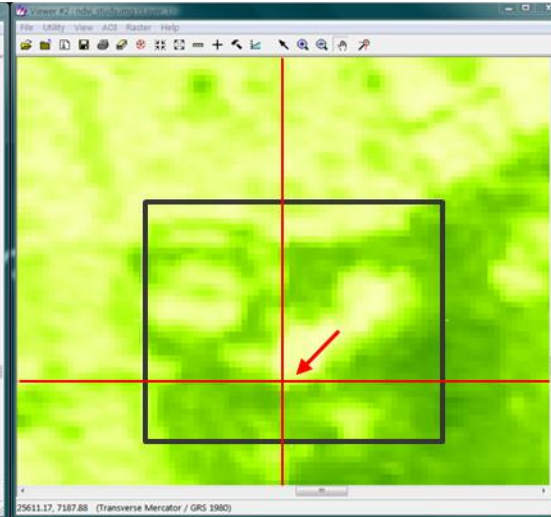
SMART ECOPATH FINDER

NDVI BINARY IMAGE

RGB True Color Ortho-image (67cm)



ALOS AVNIR-2 NDVI (5m)

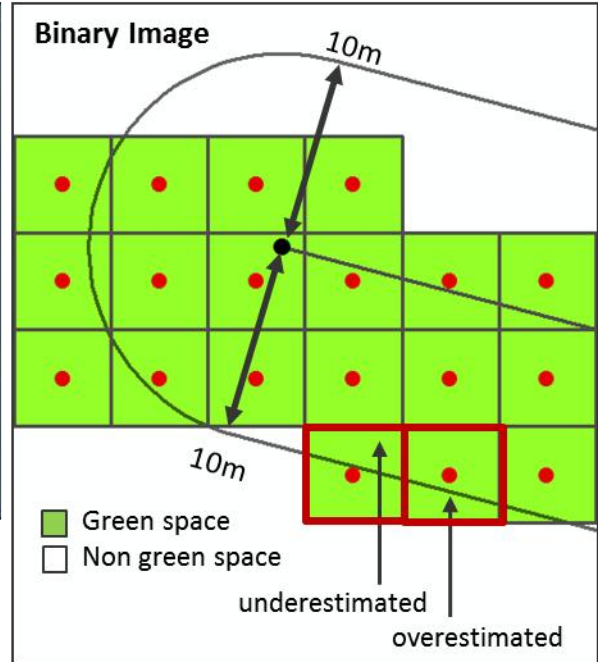
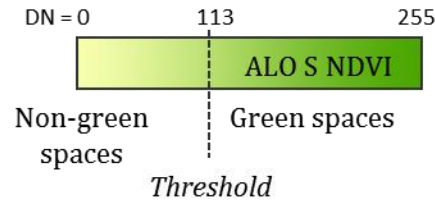


Green spaces

Forest, paddy fields and grass lands

Non-Green Spaces

Bare lands, water surface, roads and building footprints



Resampled to 5m

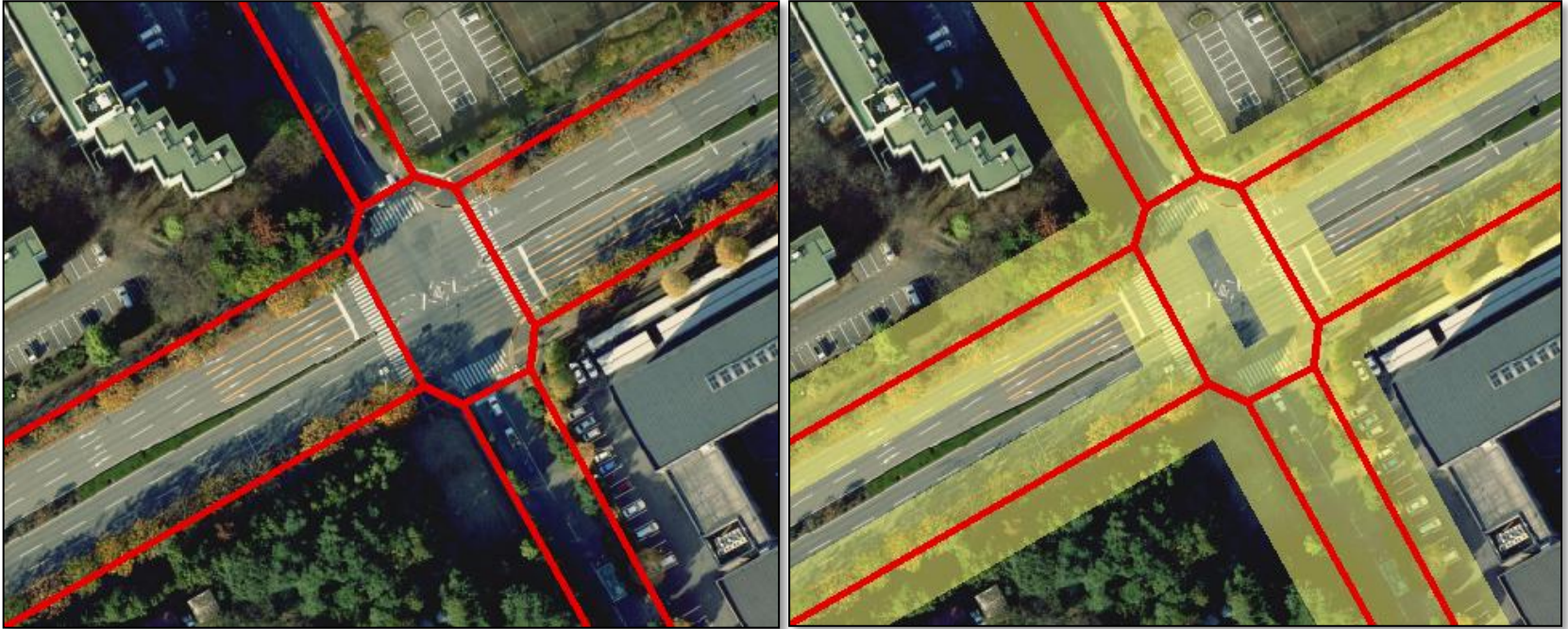
To improve between raster and vector analysis

Convert to binary image (DN = 0 – 1)



SMART ECOPATH FINDER

GIS ROAD NETWORK DATA MODEL

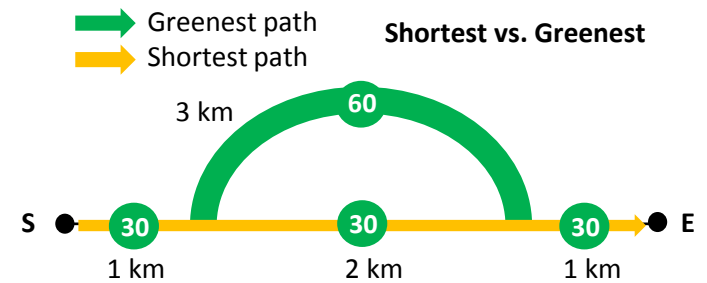
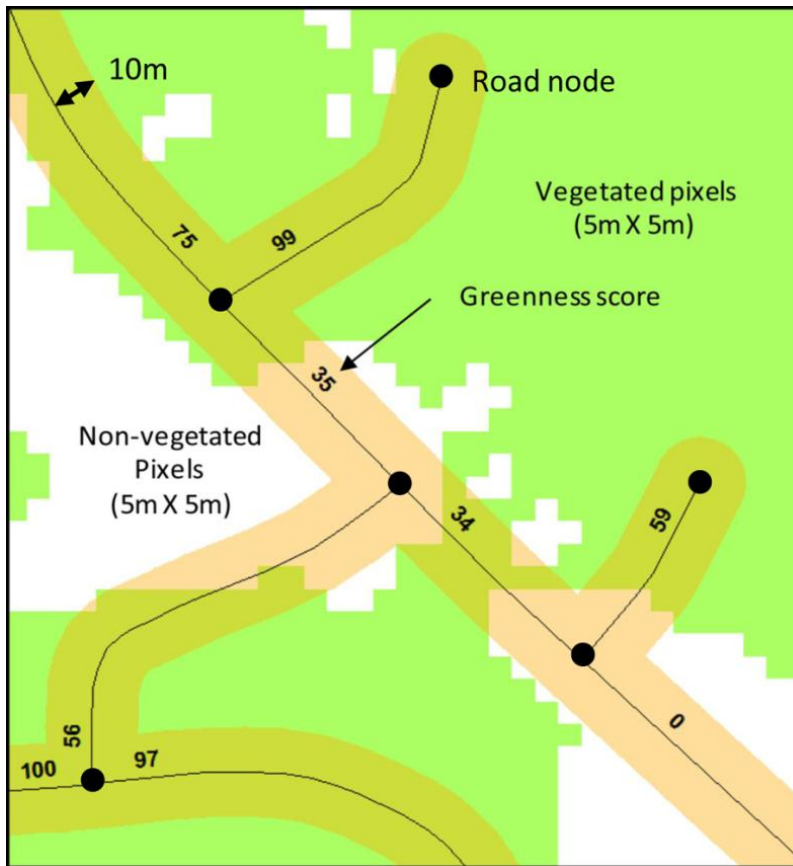


GIS Road Network Data Model preparation



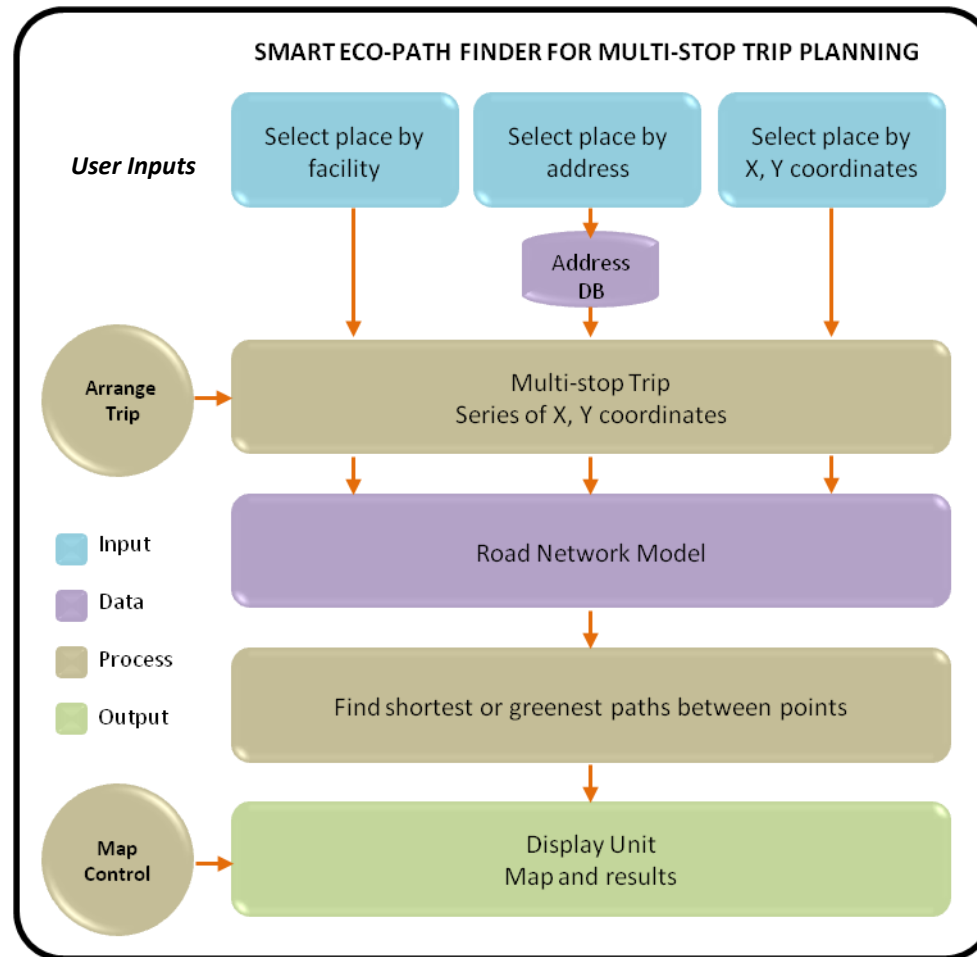
SMART ECOPATH FINDER

GREENNESS SCORE



SMART ECOPATH FINDER

SYSTEM OVERVIEW



SMART ECOPATH FINDER

HOW IT WORKS

The screenshot shows the SMART ECOPATH FINDER app interface with the following components and annotations:

- Select location by address:** Points to the "Add By Address" section with dropdowns for "Azuma 2 Chome" and "10-808", and a green "+" button. Annotation: "Add address to multi-trip plan".
- Select location by facility:** Points to the "Add By Facility" section with dropdowns for "Bank" and "Jouyouginkousaku", and a blue "+" button. Annotation: "Add facility to multi-trip plan".
- Select location by X, Y:** Points to the "Add By Map (Click on a Map)" section with an empty input field and a pink "+" button. Annotation: "Add X, Y to multi-trip plan".
- Multi-stop trip:** Points to the list of selected locations: "Azuma 2 Chome - 10-808 [X:25288.9; Y:15288.9]" and "Jouyouginkousakura branch office [X:25288.9; Y:15288.9]". Annotations: "Zoom all points" (magnifying glass icon), "Move place down" (down arrow icon), "Move place up" (up arrow icon), "Remove place" (minus icon), "Clear all places" (X icon).
- Route type selection:** Points to the "Greenest" and "Single" dropdown menus and a blue route icon. Annotation: "Find route".
- Route result:** Points to the bottom section showing a score of "79" with a green progress bar, and route information: "Route Information: Greenest", "P1-P2: 2.64Km (G.Score: 79)", "Total Distance: 2.64Km", and "Greenness Score: 79".



SMART ECOPATH FINDER

HOW IT WORKS



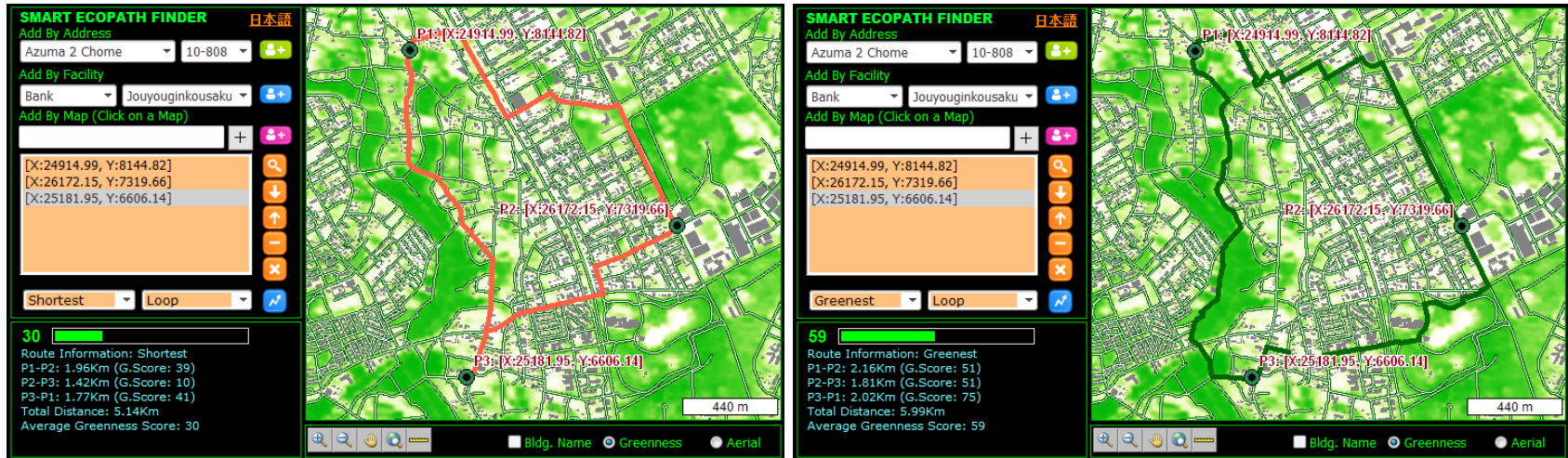
Shortest vs. Greenest



SMART ECOPATH FINDER

HOW IT WORKS

Multi-stop Trip Planning



SMART ECOPATH FINDER

HOW IT WORKS

The screenshot displays the SMART ECOPATH FINDER interface. On the left, there are three input methods: 'Add By Address' (Azuma 2 Chome, 10-808), 'Add By Facility' (Bank, Jouyouginkousaku), and 'Add By Map' (Click on a Map). Below these are coordinate input fields showing [X:26783.38, Y:5857.95] and [X:25464.25, Y:8618.37]. There are also dropdown menus for 'Greenest' and 'Single', and a 'Greenest' score of 76 with a green progress bar. The main map area shows an aerial view of a city street with a green path highlighted. A scale bar indicates 40 m. At the bottom, there are map controls (zoom, pan, home) and a legend with three options: 'Bldg. Name', 'Greenness', and 'Aerial' (which is selected and circled in red).

Provide aerial imagery for real-world visualization



THANK YOU

**MAKE IT UNIQUE
KEEP IT SIMPLE**



DIVISION OF SPATIAL INFORMATION SCIENCE, UNIVERSITY OF TSUKUBA



Project home: <http://giswin.geo.tsukuba.ac.jp/teacher/murayama/projects/ecowalkability/index.htm>

Project URL: <http://land.geo.tsukuba.ac.jp/ecowalker/>

Read more: Lwin, K. K., & Murayama, Y., (2011), Modelling of Urban Green Space Walkability: Eco-friendly Walk Score Calculator, *Computers, Environment and Urban Systems*, 35(5):408–420.
<http://www.sciencedirect.com/science/article/pii/S0198971511000469>