The 5th Japan-Korea-China Joint Conference on Geography
(Green Society in East Asia: A Geographical Contribution)

Spatial Web Technology for Urban Green Society
(A Case of Tsukuba City)

Ko Ko Lwin and Yuji Murayama

Division of Spatial Information Science
Graduates School of Life and Environmental Sciences
University of Tsukuba

kokolwin@live.com

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OBJECTIVE

Use of modern spatial web technology for local residents spatial decision making related to urban green spaces.

*Find an **eco-friendly living place** for potential home buyers*
*Find available **nearest facilities by walking** for existing local residents*
*Find the **greenest routes** for physical health activities (walking, cycling, green exercises, etc.)*

A case of Tsukuba City, Ibaraki, Japan.

URBAN GREEN SPACES

Improve mental health

Studies on the relationship between nature and health

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

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

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

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 ….*

URBAN GREEN SPACES

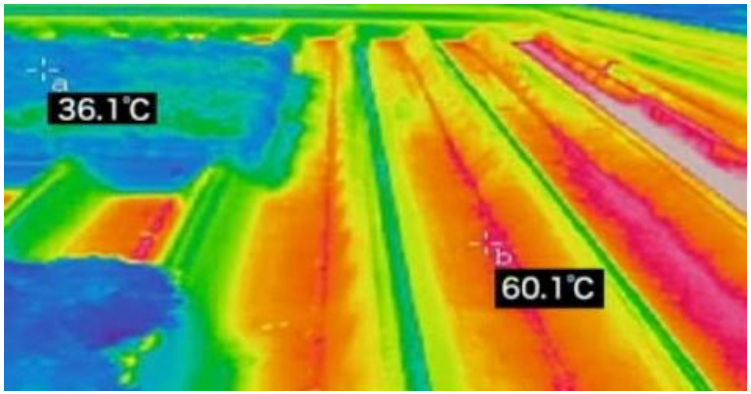
Eco-city

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)

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

SPATIAL WEB TECHNOLOGY FOR URBAN GREEN SOCIETY

Focused on:

How to utilize urban green spaces with GIST (GIScience & Technology)?
How to evaluate neighborhood environmental quality with GIST?
How to find greenest route for walking and cycling with GIST?

Geospatially Enabled Society

Emergence of Internet, wireless communication and user friendly web GIS

GIS goes everywhere (desktop to notebook → netbook/netwalker/iPad)
GIS goes professional to non-professional users (professionals/researchers → kids)
GIS is part of our daily life (Finding the place, closet facility, driving direction and route, etc.)

ECO-FRIENDLY WALK SCORE CALCULATOR

http://land.geo.tsukuba.ac.jp/ecowalkscore/

Calculate greenness score by giving home address and desire walkable distance

Calculate greenness score by user defined point

Calculate greenness score by administration block

Find available facilities by desire walkable distance

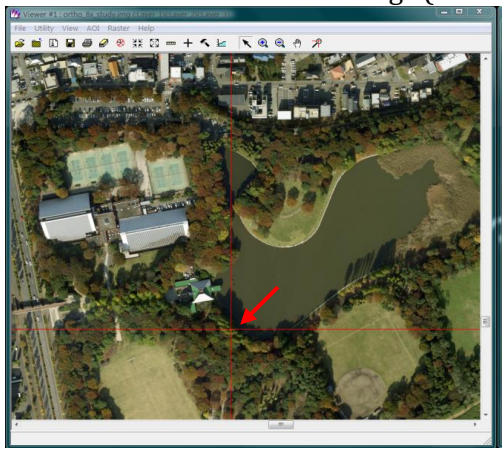
Find shortest or greenest route for walking and cycling

LIST OF DATA AND PURPOSES

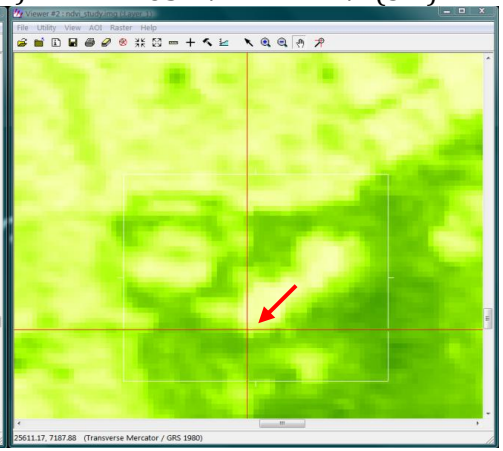
ALOS AVNIR2 Advanced Land Observing Satellite by JAXA

Calculate NDVI, identification of green spaces, calculation of greenness weighted factor for each road segment

RGB True Color Ortho-image (67cm)

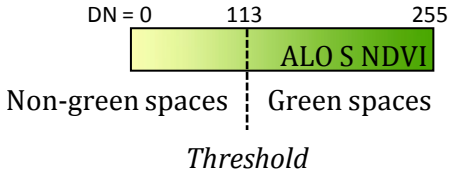


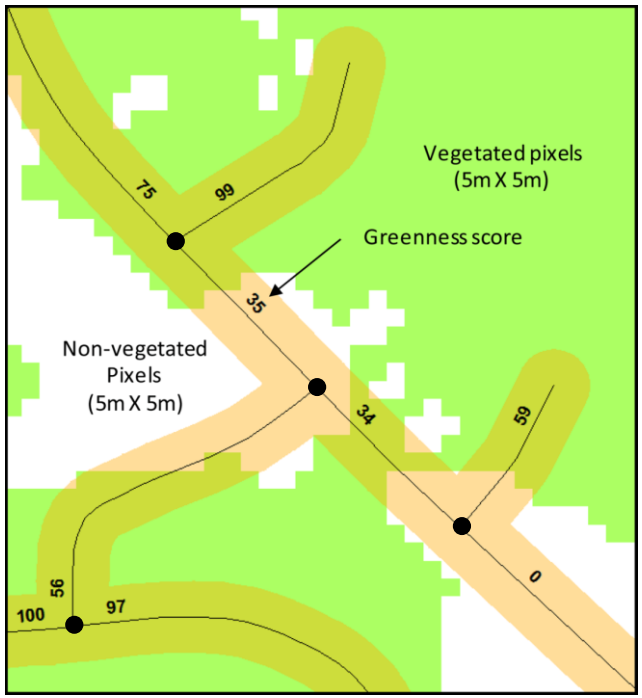
ALOS AVNIR-2 NDVI (5m)



Green spaces
Forest, paddy fields and grass lands

Non-green Spaces
Bare lands, water surface, roads and building footprints



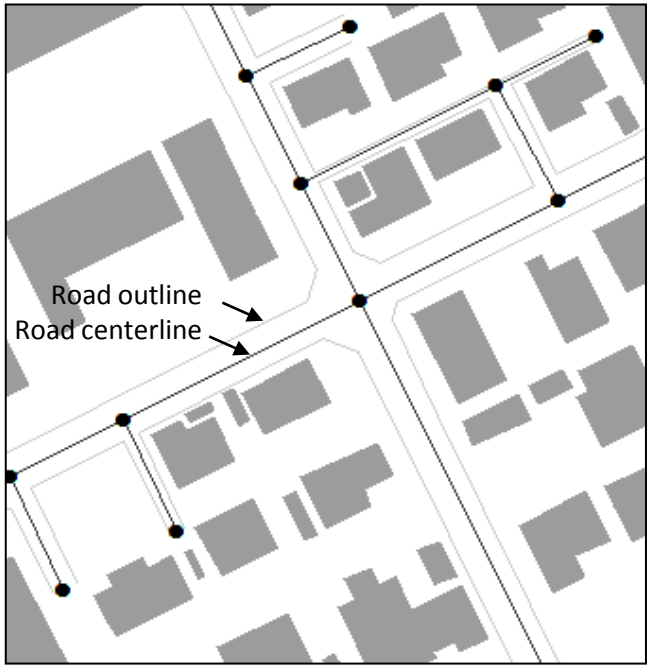


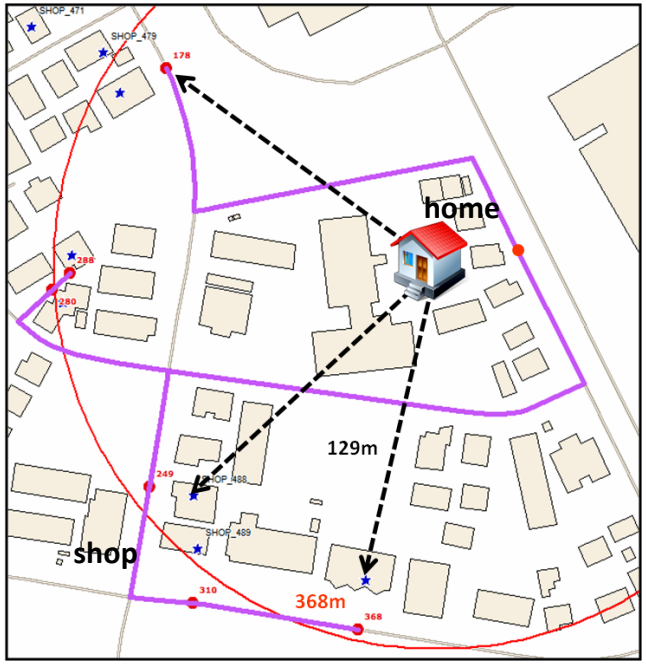
LIST OF DATA AND PURPOSES

ROAD NETWORK MODEL

Road Network Model was built on combination of Zenrin Map data and GSI data

*To measure actual **network distance** rather than crow flies distance*
(We can't fly like a bird, Okabe's comment)
*To assign **greenness weighted factor***





Crow flies distance

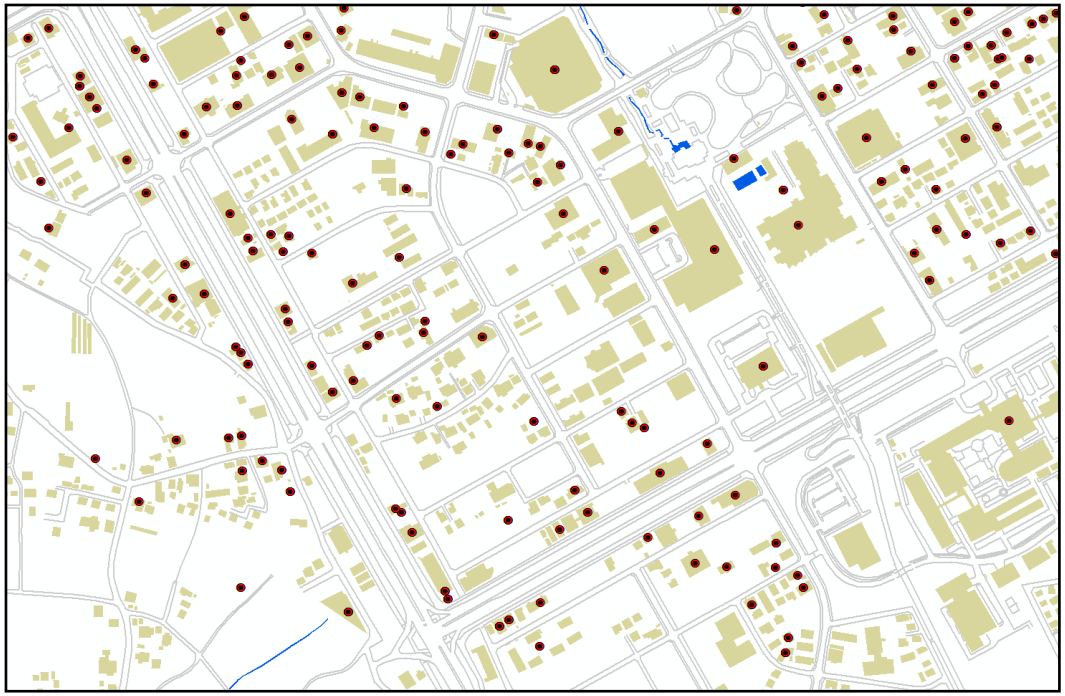
Network distance

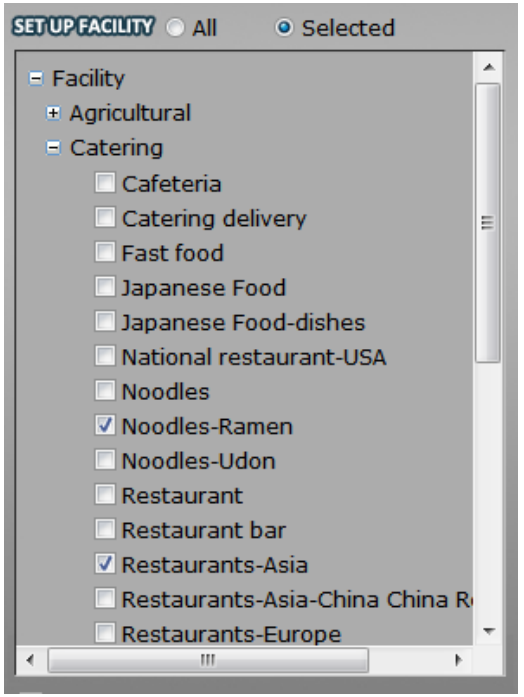
- Route analysis
- Retail market analysis
- Transportation planning
- Time-space geography (Travelling time/distance)
- more …

LIST OF DATA AND PURPOSES

NTT iTOWNPAGE (Nippon Telegraph & Telephone Corp.)

Internet TownPage which includes:
Business name, address, category, sub-category, business contents, phone number, URL, etc., in CSV Comma Separated Value format



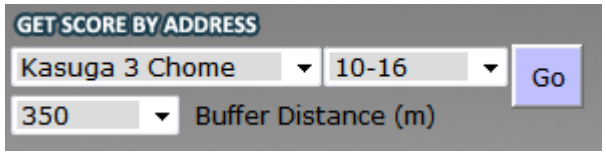


To find available and desire facility locations

LIST OF DATA AND PURPOSES

OTHERS DATASET

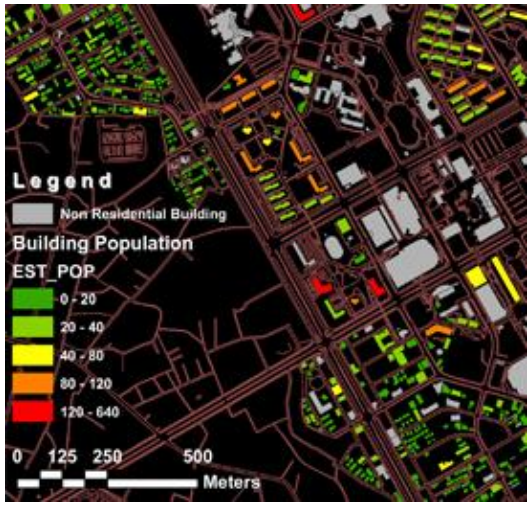
Building Footprint: *To construct an address database*
Administrative Boundary: *To construct an address database*

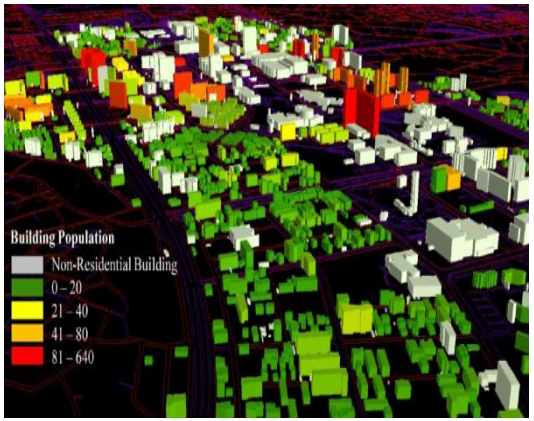


Example:
Japanese addressing system (sequence of blocks)
Kasuga 3-10-16, Tsukuba, Ibaraki, Japan 305-0821

Western or other countries
701 Lee Street Suite 680, Des Plaines, IL, 60016
500 Dover Street, City Hall, Singapore

Building foot prints data are useful for building population estimation by integration with number of floors information or building height derived from LIDAR data (Lwin and Murayama, 2009, 2010)



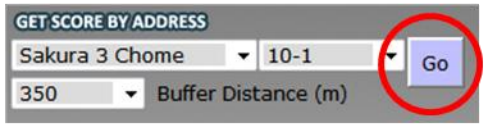


ECO-FRIENDLY WALK SCORE CALCULATOR

CALCULATE GREENNESS SCORE BY ANY ADDRESS

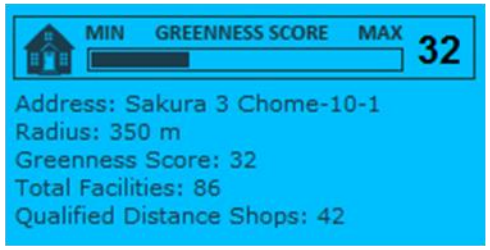
(For existing residents)

1



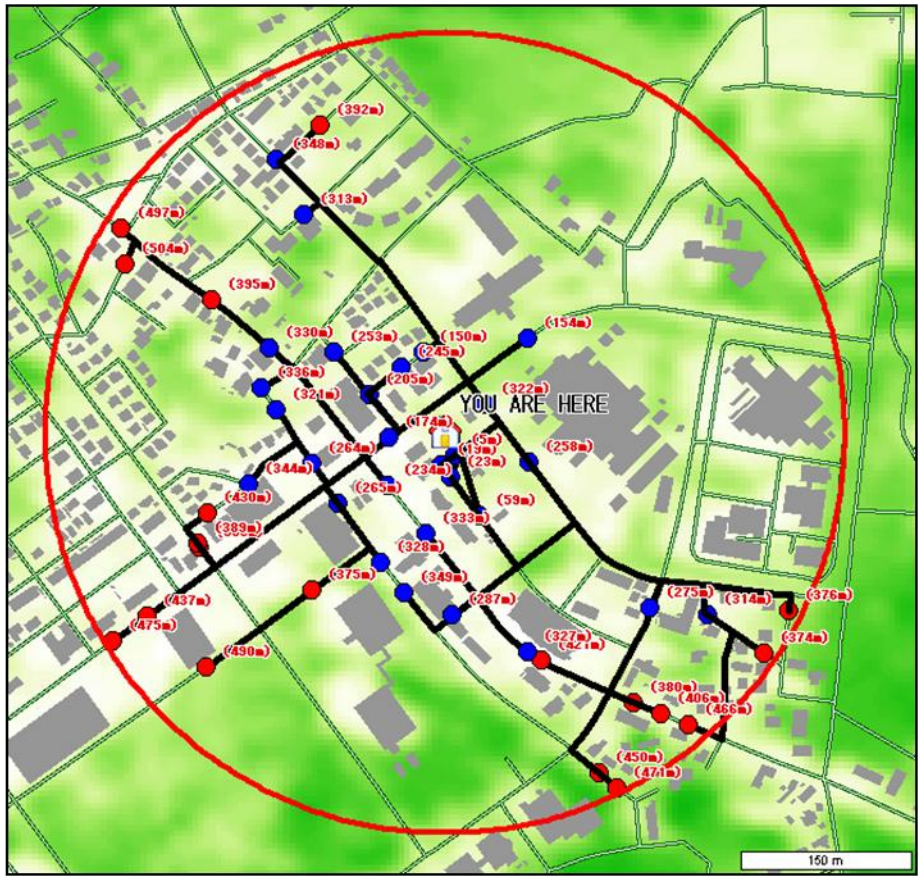
2

RESULT



Greenness Score = (GA / CA) * 100

*Qualified Distance:
Network distance < = User defined radius



ECO-FRIENDLY WALK SCORE CALCULATOR

CALCULATE GREENNESS SCORE BY ANY POINT

(For potential home buyers)

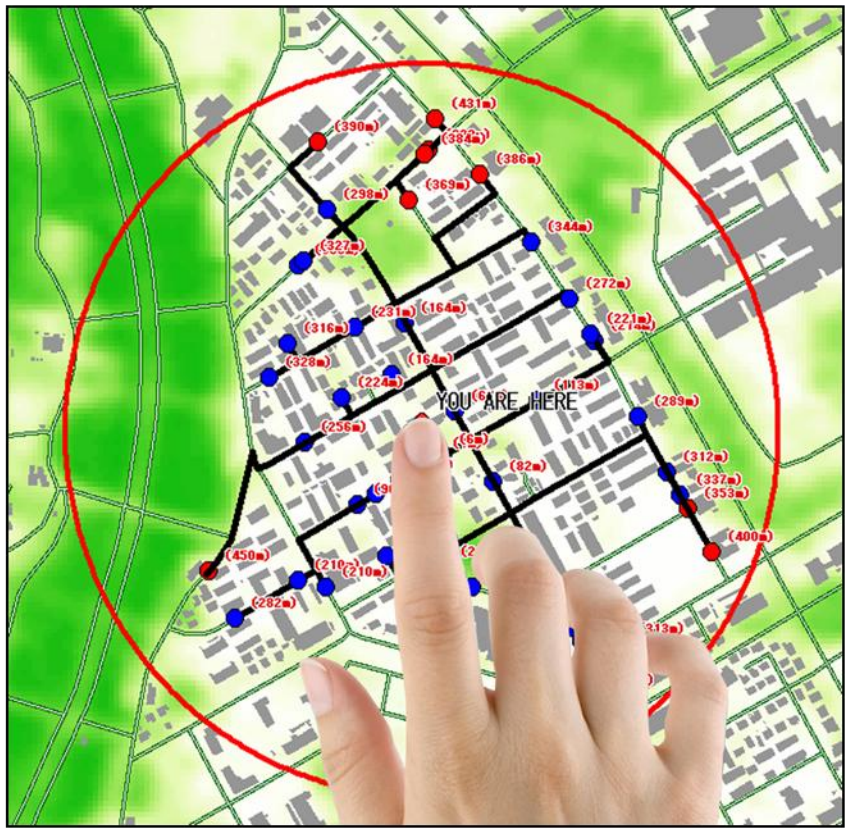
1

2

RESULT

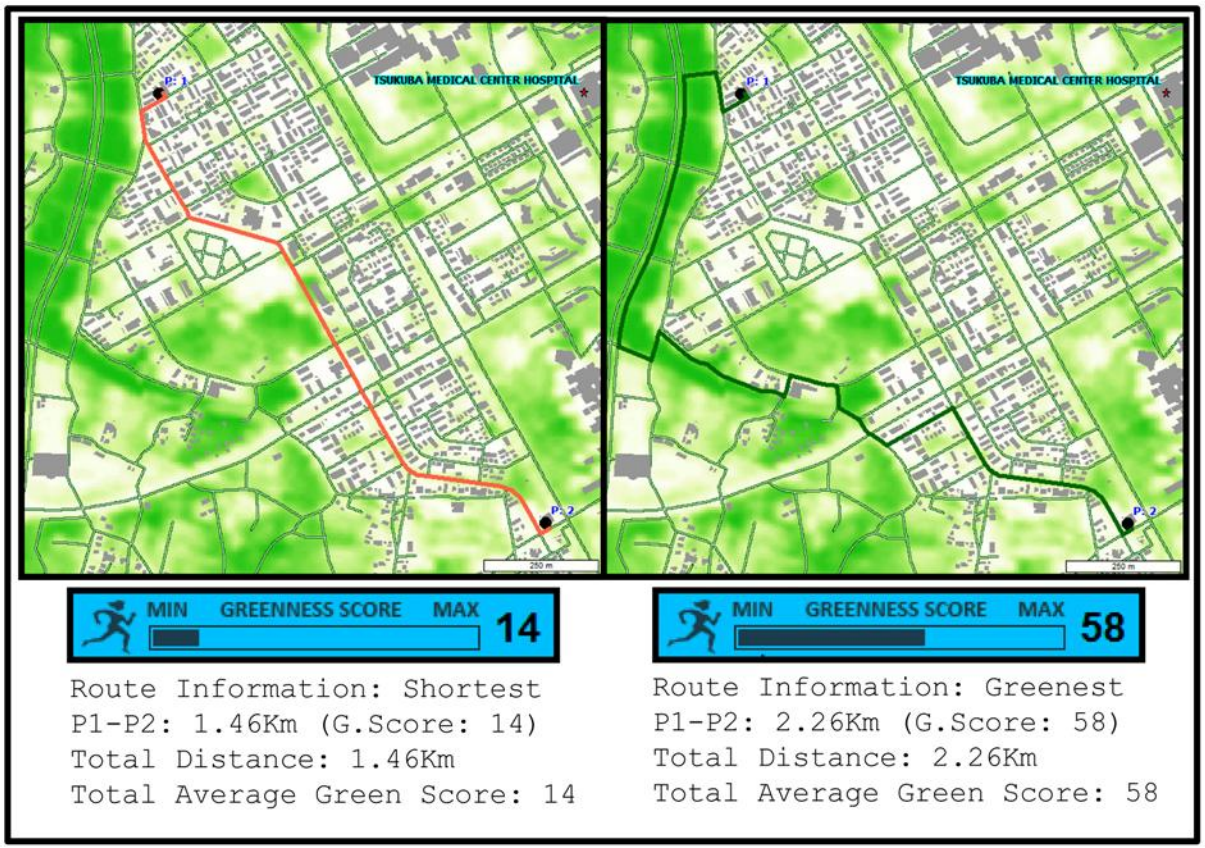
Greenness Score = (GA / CA) * 100

*Qualified Distance:
Network distance <= User defined radius



ECO-FRIENDLY WALK SCORE CALCULATOR

FIND SHORTEST OR GREENEST ROUTE



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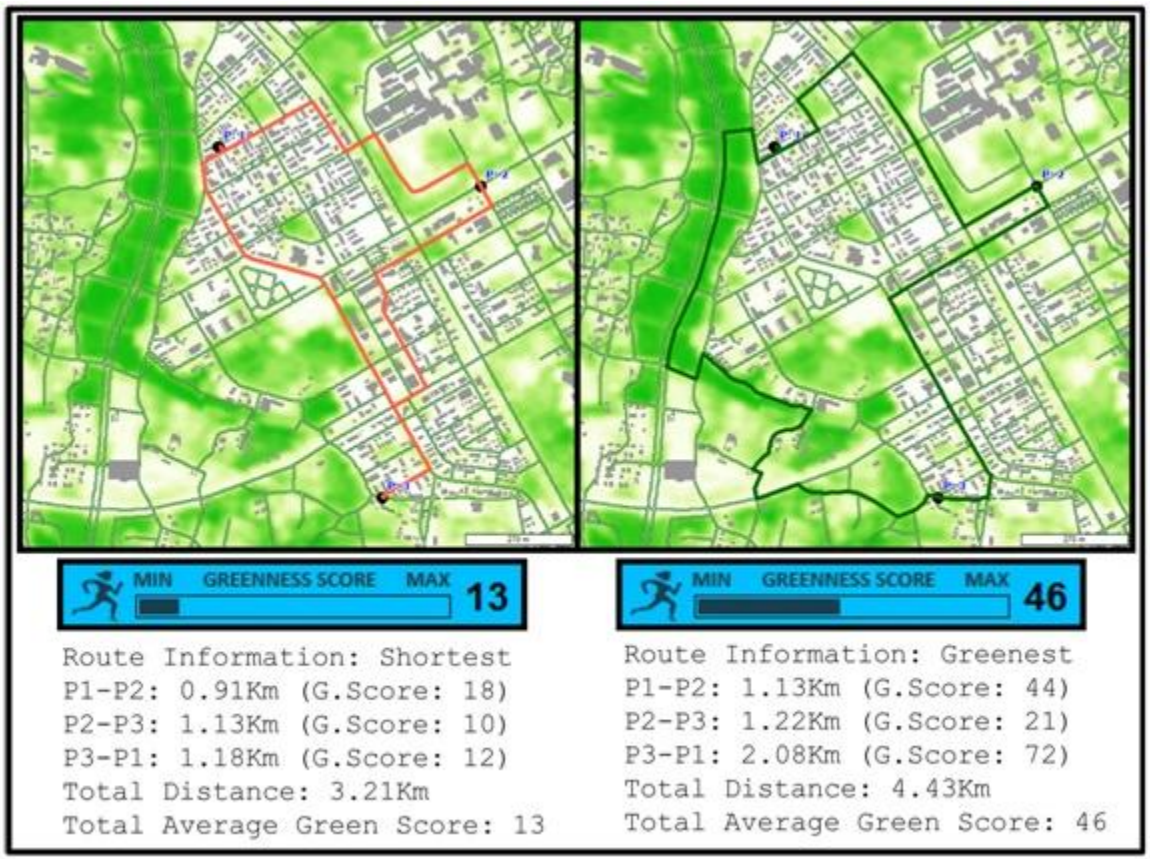

Multiple places route planning
Home > Library > Coffee shop > ...

CONCLUSION

Urban green spaces are important for human mental health improvement, social cohesion, reduce urban heat island effect, improve air quality, perform green exercises and saving energy by reducing cooling and heating demands.

GIST (GIScience and Technology) provides identification of green spaces, calculation of greenness score and route analysis to improve local residents decision making.

Modern spatial web technology provides more accessible to a much wider audience than traditional GIS. The general public can now directly access spatial information and see the analysis results through their web browsers without any installation of GIS software. The system itself is reusable and updatable.

THANK YOU!

Let's green together and joy forever ....