SPATIAL ANALYTICS · SITE SELECTION STUDY

Site Suitability Analysis Report

A programmatic, vector-based Multi-Criteria Decision Analysis for optimal retail site selection in Sonadanga, Khulna.

STUDY AREA	**Sonadanga, Khulna, Bangladesh**
METHOD	**Vector-Based Spatial MCDA**
GRID RESOLUTION	**50m × 50m (3,253 cells)**
TOOLS	**Python · GeoPandas · OSMnx**

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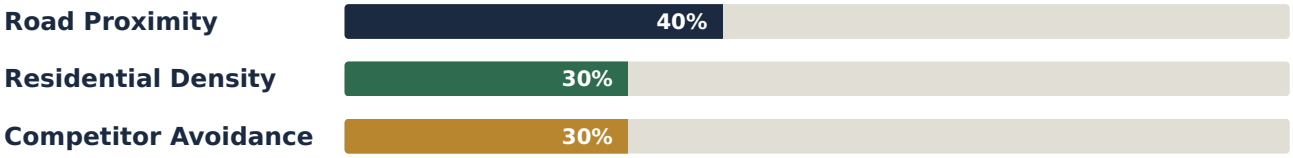
01 Project Overview

This project demonstrates a programmatic approach to Spatial Multi-Criteria Decision Analysis (MCDA). The primary goal is to find the most suitable 50-meter land parcels for establishing a new retail business by evaluating geographic conditions without relying on traditional manual GIS desktop software.

Location & Objective

Study Area: Sonadanga, Khulna, Bangladesh. This area was selected as it represents a rapidly developing urban landscape, ideal for micro-level spatial planning. The objective is to pinpoint exact blocks where a business can maximize foot traffic while minimizing market competition.

02 Analysis Criteria & Justification



A. Road Proximity

40%

Closer proximity to road networks ensures better accessibility for customers and smoother logistics.

B. Residential Density

30%

Establishing near residential buildings guarantees a higher local consumer base.

C. Competitor Avoidance

30%

Maximizing distance from existing shops reduces market saturation and business overlap.

03 Data Source & Limitations

All spatial data was programmatically retrieved from OpenStreetMap (OSM), covering road networks, residential building footprints, and commercial points of interest.

> **Disclaimer:** As OSM relies on Volunteered Geographic Information (VGI), the dataset may not be 100% complete for this specific region. Some local shops or newly constructed homes might be missing. Furthermore, the criteria used are simplified constructs meant strictly for educational and foundational learning purposes.

Technology Stack Used

- **GeoPandas** — core vector spatial operations & geometry manipulation
- **OSMnx** — automated street network & POI data retrieval
- **Pandas** — data aggregation & summary statistics
- **Matplotlib** — color-coded spatial map rendering

04 Individual Criteria Analysis

The following maps illustrate the isolated spatial distribution of each condition across all 3,253 grid cells. Green areas indicate high suitability based solely on that specific rule.

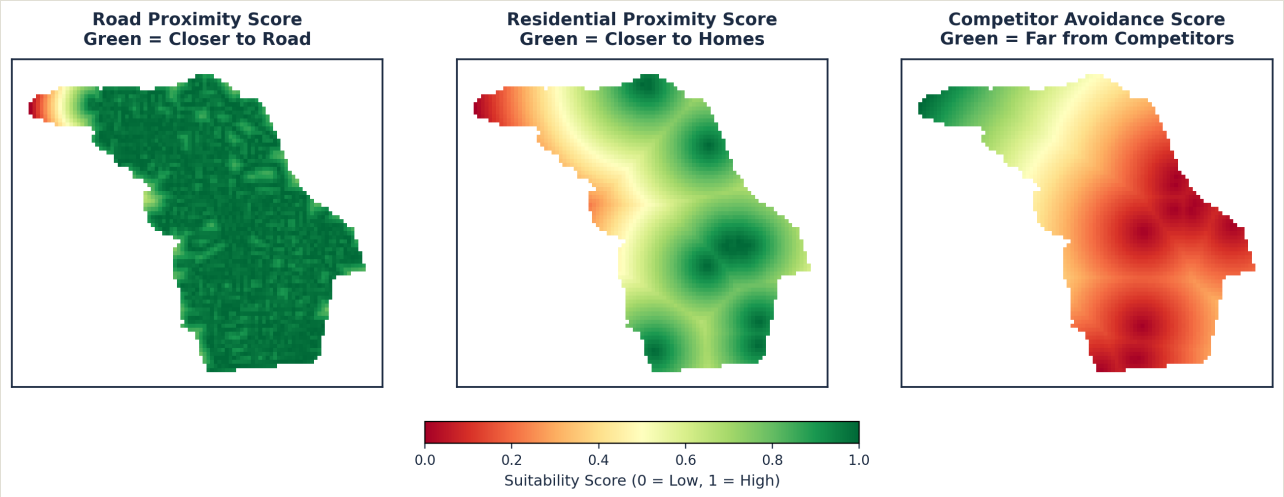


Figure 1. Left to right — road proximity, residential proximity, and competitor avoidance scores, each normalized on a 0–1 scale.

05 Final Weighted Suitability Output

Combining the individual criteria using their respective weights yields the final suitability map below. Darker red shades represent optimal sites for a new retail business.

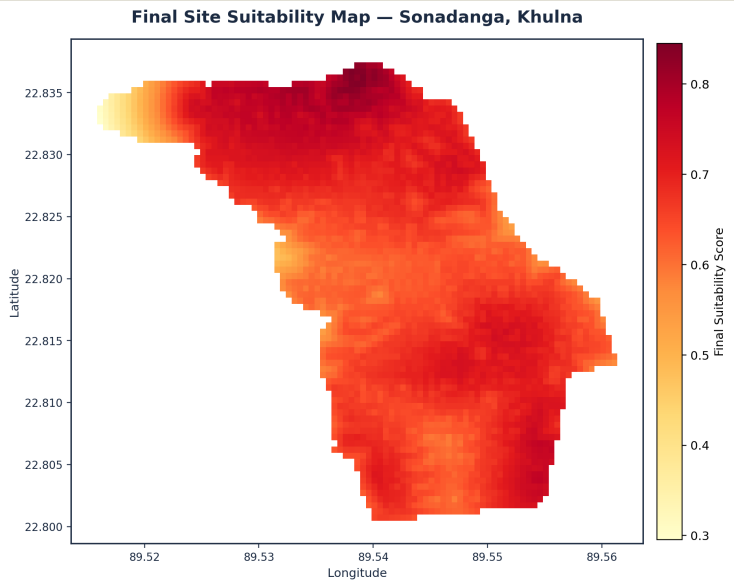


Figure 2. Final Site Suitability Map — Sonadanga, Khulna. Score computed as 0.4 × Road + 0.3 × Residential + 0.3 × Competitor Avoidance.

Summary Statistics

Low — 0.68% Medium — 65.97% High — 33.35%

SUITABILITY CLASS	TOTAL 50M CELLS	PERCENTAGE
Low	22	0.68%
Medium	2,146	65.97%
High	1,085	33.35%

Conclusion

This automated pipeline successfully identifies the most lucrative micro-locations in the study area. Despite the limitations of open-source data, the methodological framework provides a solid foundation for data-driven urban planning and retail site selection.