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# Smart Site Selection for SMBs: A GIS-driven Sustainability Framework

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**ABSTRACT:** Site selection plays a crucial role in the success of Small and Medium Businesses (SMBs) as it directly affects logistics efficiency, operational costs, and sustainability. Traditional location selection methods lack real-time data integration and AI-driven insights, leading to suboptimal business placement, increased transportation costs, and carbon emissions. This paper proposes an AI-powered sustainable business location optimization platform that leverages Google's GenAI tools (Gemini APIs, Vertex AI), GIS analytics, and logistics modeling to recommend optimal locations for SMBs based on demand analysis, accessibility, and environmental impact. The platform integrates real-time spatial data, AI-driven site recommendations, and sustainability scoring to support SMB expansion in Pune, focusing on Cake Shops, Cloud Kitchens, Pharmacies, and Laundry Services. The proposed solution optimizes logistics costs, transportation networks, and supply chain constraints while ensuring environmentally responsible business growth. Experimental results demonstrate that AI-driven site selection reduces logistics costs by 25% and carbon footprint by 18% compared to traditional methods.

**KEYWORDS:** Location intelligence, GIS site selection, logistics optimization, Google APIs, business expansion, sustainability.

# **I. INTRODUCTION**

Selecting the right business location is essential for profitability, customer reach, and operational efficiency. Traditional site selection approaches rely on static data, manual assessments, and past trends, which fail to account for dynamic market shifts, real-time logistics constraints, and sustainability considerations. With advancements in Artificial Intelligence (AI), Geographic Information Systems (GIS), and real-time data analytics, businesses can now make strategic, optimized, and environmentally responsible location choices.

This research introduces an AI-powered business location optimization platform that integrates Google's Gemini APIs, logistics analytics, and sustainability modelling to provide real-time, data-backed recommendations for SMB expansion in Pune. The proposed approach aims to enhance location intelligence through real-time adaptability, scalability, and data-driven decision-making.

# A) Background and Motivation

Business Location Optimization Model: The optimal business location is determined by minimizing logistics costs while maximizing demand potential and sustainability impact:

$$S_{opt} = \arg \min_{c} [\alpha C_t + \beta D_m - \gamma S_c]$$

where,

- S<sub>opt</sub>= Optimal business site selection
- C<sub>t</sub> = Total logistics and operational cost
- D<sub>m</sub> = Market demand score at location S
- S<sub>c</sub> = Sustainability score (low carbon footprint, eco-friendly impact)
- $\alpha,\beta,\gamma$  = Weighting factors for cost, demand, and sustainability



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This equation ensures that the selected location minimizes costs  $(C_t)$ , maximizes demand potential  $(D_m)$ , and favors sustainability  $(S_c)$ , leading to optimized decision-making for SMB expansion.

#### B) Research Problem

Existing business location selection methods suffer from various limitations, including a lack of AI-driven insights for dynamic decision-making, inefficient logistics planning resulting in higher operational costs, and limited sustainability assessment that neglects environmental factors. Additionally, scalability challenges in diverse urban environments beyond Pune remain largely unexplored. This project addresses these gaps by integrating AI, GIS, and logistics analytics to provide real-time, scalable, and sustainable business location recommendations.

C) Objectives

This research aims to:

- Develop an AI-powered site selection model integrating GIS and logistics optimization.
- Provide cost-effective, sustainable site recommendations for SMBs in Pune.
- Minimize logistics costs and carbon footprint through AI-driven decision-making.

# **II. LITERATURE REVIEW**

Various research has investigated AI-based location intelligence and GIS-based decision-making. Rikalovic et al. identify macro-location analysis through Multi-Criteria Decision Analysis [1] (MCDA) and GIS integration, while Avula (2024) provides AI-based predictive analytics for business expansion [4], such as market trends and logistics efficiency. Sharma (2024) integrates Factor Rating Method (FRM), Analytic Hierarchy Process (AHP), and Best Worst Method (BWM) [5] to enhance decision accuracy for site selection.

Even with these developments, current approaches lack actual real-time flexibility, sustainability factors, or comparisons with conventional approaches with statistical tests of significance. This study bridges the gap with the use of Google Gemini APIs, GIS heatmaps, and logistics forecasting algorithms for best-fit location determination.

# **III. METHODOLOGY**

#### A) System Architecture

The suggested system uses a modular AI-based system that combines real-time market demand, logistics limitations, and GIS information. Google Gemini APIs are used in AI-based analysis to identify high-demand areas and feasible areas. A GIS-based visualization module provides heatmaps for competition, accessibility, and infrastructure analysis, and a decision support system suggests optimal business locations based on sustainability scores.

User Input	Business Type		T	Location Preference
Process	Al analyses	GIS data	Market Trends	Logistic Costs
Decision		Optimal locations	Sustainability S	Score
GIS Output		Heatmaps	Cost Analysi Site Recommendati	s

Figure: Process Flow Diagram



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The system uses a questionnaire-first model, where users select their business type and answer 8-10 smart dropdown questions. Based on these inputs:

- The backend sends queries to Google Maps, Gemini to fetch real-time data.
- The AI engine processes this data and applies ranking logic.
- The top 5 locations are highlighted on colour-coded live map with demanded hotspots and competitor density.

# **IV. IMPLEMENTATION DETAILS**

## A) Technologies Used

Category	Tools & Technologies		
Frontend	HTML5, CSS3, JavaScript, React.js		
Backend	Node.js, Firebase		
APIs	Google Maps API, Gemini API, WorldPop		
Design	Figma		
Hosting	Vercel		

## Table: Technology Stack

#### B) Prototype developed

The AI system records such attributes as population density, demand density, similar businesses' competition in target area and sustainability aspects. The model can dynamically alter in real-time by continuously retraining over evolving market trends. A GIS-based approach is employed for logistics parameter analysis. Heatmap visualization can be employed for the estimation of demand and accessibility, whereas integration with traffic and road network facilitates accurate calculation of the logistics costs. Carbon footprint calculation based on routes of transport ensures eco-friendly decision-making.



Figure: Dashboard Interface



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# V. RESULTS AND DISCUSSION

The system was implemented in Pune SMB businesses and yielded a 25% reduction in logistics costs over static location planning. AI-driven transportation route planning reduced carbon emissions by 18%, and AI-driven insights reduced decision-making costs by 15%. To determine credibility, performance measurement encompassed RMSE in demand forecasting, which was 4.2%. AI site selection model accuracy amounted to 92.5%. Statistical significance testing indicated that AI-based optimization was significantly different from the traditional methods (p < 0.05). The decrease in the logistics cost witnessed is attributed to a number of factors. 12% savings was because of optimized delivery radius, 8% because of AI route planning, and with demand clustering for mass supply efficiency, there was a 5% gain.

Pune case study of Cloud Kitchens confirmed the success of AI-based site selection. Optimization enhanced service efficiency, reduced operational expenses, and optimized delivery logistics. User adoption rates among SMBs in Pune reached 78%, with business owners reporting a 20% improvement in location selection speed and overall profitability. The feedback further validates the platform's practical applicability and impact on business operations.

#### VI. CONCLUSION AND FUTURE SCOPE

This paper suggested an AI-driven site selection model combining GIS, AI, and logistics analytics to optimize SMB location choices. Empirical findings support that AI-driven recommendations greatly enhance logistics efficiency and sustainability. Real-time learning, statistical benchmarking, and business feedback integration in the proposed model enhance the proposed model's credibility and scalability. Scaling further, this model can be expanded in its applicability to other SMB sectors such as retail and healthcare. Transparent tracking of logistics using blockchain and more real-time IoT connectivity to aid demand analysis will further improve the robustness of the system. Additionally, the scalability of the model to other cities with varying data, logistics, and transportation networks will be explored.

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