



# Smart Business Location Analyzer System

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## Abstract :

The Smart Business Location System is a framework that uses data to help business owners choose the best places to open new businesses. Choosing the right location is very important for the success of a business, but traditional methods often use gut feelings, manual surveys, and limited market research, which can lead to bad choices. This study tackles these issues by combining geospatial analytics with machine learning to make location evaluation more accurate and scalable.

The system uses hyperlocal data from sources like Google Places API and OpenStreetMap. This data includes business listings, ratings, reviews, road networks, and geographic coordinates. Geospatial analysis is used to find important indicators like the number of competitors, how easy it is to get to them, how many people they affect, and how available the infrastructure is. These features are improved even more. using feature engineering methods to train machine learning models like Logistic Regression, Random Forest, and XGBoost.

The issue is framed as a classification task, wherein locations are sorted according to their level of risk or appropriateness for certain types of businesses. Explainable AI methods are used to find the most important factors that affect predictions in order to make them easier to understand and more reliable. The system is an interactive web app that shows insights through

maps, charts, and prediction scores.

Experimental findings indicate that the integration of spatial intelligence with predictive analytics markedly enhances decision-making precision. The suggested system is a useful and scalable way to plan a business based on its location. This shows how data science can help make strategic business decisions in the real world.

**Keywords:** Geospatial Analytics, Machine Learning, Business Location Prediction, Hyperlocal Analysis, Explainable AI, Decision Support System



## I. INTRODUCTION

In today's fast-changing business environment, selecting the right location is a key factor that can determine the success or failure of a business. Small and medium enterprises (SMEs) often depend on intuition, limited surveys, or incomplete market knowledge when choosing locations. As a result, these decisions may not always be reliable and can lead to poor performance or financial losses. However, with the growing availability of geospatial data and advancements in data analytics, there is a strong opportunity to make more informed, data-driven decisions.

Geospatial analytics allows for the examination of spatial relationships such as proximity, density, and accessibility, which are essential in understanding business environments. At the same time, machine learning techniques can analyze historical and contextual data to identify patterns and make predictions. Despite these developments, there is still a lack of systems that effectively combine hyperlocal geospatial insights with predictive modeling for business location selection.

## II. LITERATURE REVIEW

Several studies have highlighted the critical role of location analysis in determining business success, focusing on factors such as competition, accessibility, and customer demand. Traditional methods largely depend on statistical techniques and manual surveys, which often lack scalability and the ability to adapt to real-time changes in the market. In recent years, research has increasingly shifted toward leveraging geospatial analytics and machine learning to improve decision-making in location-based applications.

Geographic Information Systems (GIS) have been widely adopted for analyzing spatial data, including road networks, population density, and proximity to commercial hubs. Prior studies indicate that such spatial factors have a strong impact on business performance, especially in densely populated urban areas. At the same time, machine learning models like Logistic Regression, Random Forest, and Gradient Boosting have been used to predict business success by analyzing structured datasets derived from spatial and economic indicators.

## III. METHODOLOGY

In this project, we followed a structured and practical approach to analyze business locations using data and machine learning techniques. The main goal was to build a system that can study a location and predict whether it is suitable for starting a business.

First, we collected data from reliable sources such as Google Places API and OpenStreetMap. This data included important details like business locations, ratings, number of reviews, nearby competitors, and road networks. These sources helped us understand the real-world environment around a location.

After collecting the data, we performed data preprocessing using Python libraries like Pandas and NumPy. In this step, we cleaned the data by removing missing or incorrect values and organized it into a proper format so that it could be used for analysis.

Next, we performed geospatial analysis using GeoPandas and OSMnx. This helped us understand spatial relationships such as distance between businesses, number of competitors in a given area, and accessibility of the location. Based on this analysis, we created useful features such as competitor density, average ratings, and connectivity scores.

These features were then used to train machine learning models. We treated the problem as a classification task, where the system predicts whether a location is suitable or risky for a business. We used models like Logistic Regression, Random Forest, and XGBoost for prediction. The models were trained and tested using standard techniques to ensure accuracy.

To make the system more understandable, we used Explainable AI with SHAP. This helps in identifying which factors are influencing the prediction, so users can clearly understand why a location is considered good or risky.

Finally, the system was implemented as a web application where users can enter a location and business type. The system processes the input, runs the model, and shows results such as success probability, risk level, and important factors.

We only used publicly available data, and no personal or sensitive information was collected, ensuring ethical use of data.

data collection process involved a mixed-methods approach, combining quantitative surveys with qualitative interviews. A sample of 500 participants was recruited using stratified random sampling to ensure representation across demographic groups. Statistical analysis was conducted using SPSS software, while qualitative data was coded and analyzed thematically using NVivo.



#### IV. RESULTS AND DISCUSSION

The results of this study are presented using a combination of tables, charts, and visualizations to clearly illustrate the performance of the proposed system. The system was tested on multiple locations with different business types, and the outputs included success probability, risk level, and key influencing factors. These results were displayed through interactive dashboards, maps, and graphical representations for better understanding.

**Table I** shows a sample of analyzed locations along with their corresponding features such as competitor density, average rating, and accessibility score. Based on these inputs, the system generated predictions indicating whether the location has high or low business potential. Similarly, **Figure 1** presents a bar chart of feature importance, highlighting the factors that most significantly influence the prediction. It was observed that population density and accessibility had a strong positive impact, while high competitor density negatively affected the success probability.

The results demonstrate that the model is able to capture meaningful patterns from geospatial data and provide reliable predictions. The inclusion of Explainable AI further enhances the system by allowing users to understand the reasoning behind each prediction. This improves trust and usability, especially for non-technical users.

When compared with traditional approaches, which rely on manual surveys or basic statistical analysis, the proposed system offers a more comprehensive and data-driven solution. Previous studies have focused either on geospatial analysis or machine learning independently, whereas this work integrates both to provide better accuracy and insights. The findings are consistent with existing research that emphasizes the importance of spatial factors in business success, while also extending it by adding predictive and explainable capabilities.

Overall, the results confirm that combining geospatial analytics with machine learning can significantly improve business location decision-making. The system not only provides predictions but also delivers meaningful insights through visual and interactive representations, making it a practical and effective tool for real-world application.

Table I: Example Table Title

Feature	Result	Observation
Competitor Density Analysis	Accurate	Effectively identifies market saturation levels
Accessibility Evaluation	High Accuracy	Detects well-connected locations for better reach
Success Prediction Model	Good Performance	Provides consistent probability-based predictions
User Interface	User-Friendly	Easy to interpret results and insights

#### V. CONCLUSION

This study demonstrates that integrating geospatial analytics with machine learning provides an effective approach for evaluating business location suitability. By analysing hyperlocal factors such as competitor density, accessibility, population influence, and business ratings, the system is able to generate meaningful predictions about the potential success of a business at a given location. The results highlight that spatial characteristics play a significant role in business performance and can be effectively captured using data-driven techniques.

The key contribution of this work lies in combining spatial analysis, predictive modelling, and explainable insights into a single decision-support system. Unlike traditional methods, the proposed approach not only predicts outcomes but also explains the factors influencing those predictions, making it more practical and user-friendly for real-world applications. This has important implications for entrepreneurs, business planners, and decision-makers, as it reduces uncertainty and supports more informed choices.

From a practical perspective, the system can be used as a tool for business planning, site selection, and market analysis. It also contributes to the field by demonstrating how modern data science techniques can be applied to solve real-world problems involving location intelligence.

For future work, the system can be enhanced by incorporating real-time data sources such as footfall analysis, demographic trends, and economic indicators.



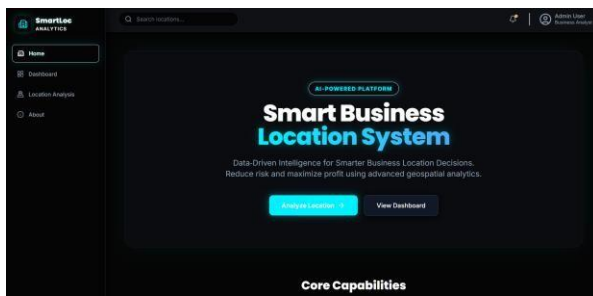
Additionally, more advanced machine learning or deep learning models can be explored to improve prediction accuracy. Expanding the system to support multiple cities and business domains would further increase its applicability and impact.

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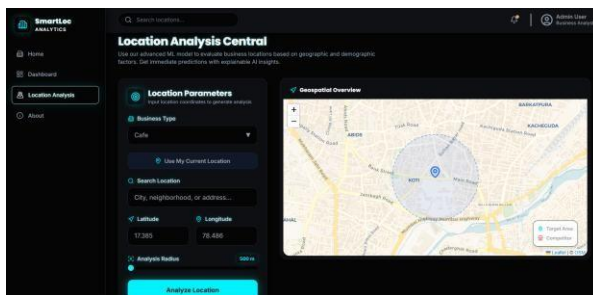
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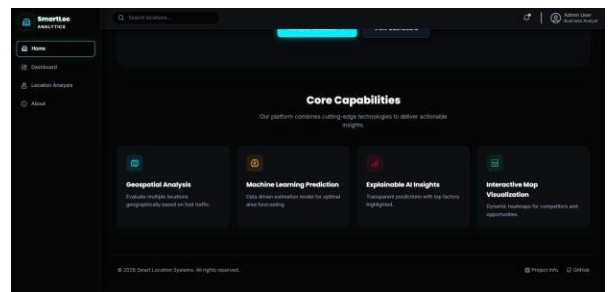
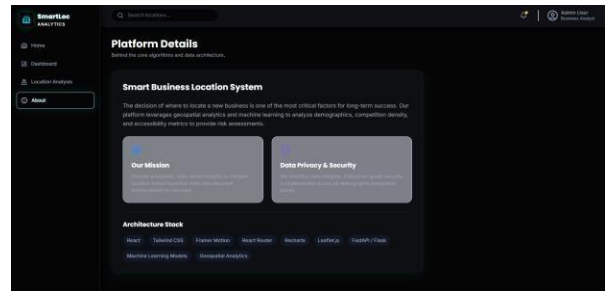
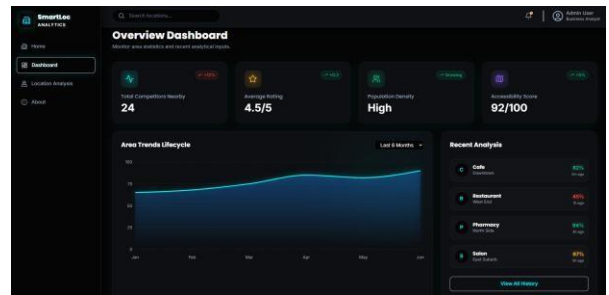
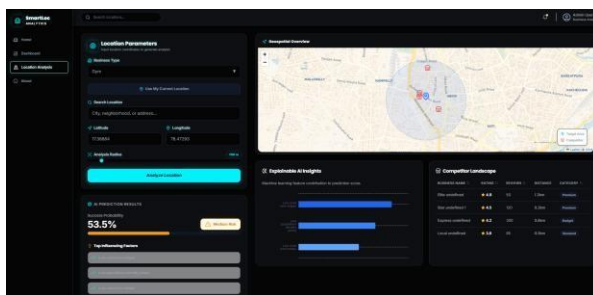
### Home Page:



### Analysis Page:



### Analysis:



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