

AI-Based Predictive Model for Interior Design

Suraj Bharat Khandekar

E-mail: khandekars108@gmail.com

Prof. Ramkrishna More Arts ,Commerce and Science College(Autonomous) Pradhikaran, Pune -411044
India

Dr. Santosh Jagtap

E-mail: st.jagtap@gmail.com

Prof. Ramkrishna More Arts ,Commerce and Science College(Autonomous) Pradhikaran, Pune -411044
India.

1. Abstract

Interior design projects involve complex planning processes that include budgeting, material selection, labor management, and project scheduling. Traditional estimation methods often rely on manual calculations and personal experience, which may lead to inaccurate cost predictions and project delays. With the advancement of Artificial Intelligence (AI), predictive models can analyze historical data and provide accurate forecasting for future projects.

This project focuses on developing an AI-based predictive model that can estimate project costs and timelines for interior design projects. The model uses historical project data such as project size, material costs, labor costs, and design complexity to identify patterns and generate predictions. The proposed system aims to assist interior designers and project managers in improving planning accuracy, reducing cost overruns, and enhancing project management efficiency.

The results of the study demonstrate how AI-driven predictive analysis can improve decision-making in the interior design industry. The project highlights the importance of integrating modern technologies to optimize budgeting, resource allocation, and project scheduling.

2. Introduction

Interior design plays an essential role in enhancing the functionality and aesthetics of residential and commercial spaces. A typical interior design project involves several stages including planning, budgeting, design development, procurement of materials, and project execution. Managing these stages effectively is crucial for ensuring successful project completion.

However, traditional project estimation methods often rely on past experience and manual calculations. These approaches may not always consider important variables such as fluctuating material costs, labor availability, project complexity, and market conditions. As a result, projects may experience budget overruns and delays.

Artificial Intelligence (AI) and machine learning technologies have introduced new opportunities for improving predictive analysis and decision-making. AI-based predictive models can analyze large datasets from past projects to identify patterns and relationships between different project variables. These models can then generate accurate predictions for future projects.

This study aims to develop an AI-based predictive model that can estimate project budgets and timelines for interior design projects. By leveraging data-driven insights, the model can help designers and project managers improve planning accuracy and reduce project risks.

3. Background of the Study

The interior design industry has grown rapidly due to increasing demand for well-designed residential and commercial spaces. With this growth, projects have become more complex and require efficient planning and management. One of the biggest challenges in interior design project management is accurate cost estimation.

Traditional estimation methods depend on designer experience, standard cost references, and manual calculations. These approaches may not fully capture dynamic factors such as price fluctuations, material availability, and project-specific requirements.

Artificial Intelligence has been widely used in industries such as construction, manufacturing, and finance for predictive analysis. AI-based predictive models use machine learning algorithms to analyze historical data and generate forecasts for future events.

Applying AI techniques to interior design project management can significantly improve cost estimation and scheduling accuracy. This study explores the potential of AI in developing predictive models specifically designed for interior design projects.

4. Problem Statement

Interior design projects often face challenges related to inaccurate cost estimation and project scheduling. Traditional estimation methods rely heavily on human judgment and manual calculations, which can lead to errors and inconsistencies.

These challenges can result in:

- Budget overruns
- Project delays
- Inefficient resource allocation
- Reduced client satisfaction

Therefore, there is a need for a more reliable and data-driven approach to estimate project costs and timelines. An AI-based predictive model can analyze historical data and provide more accurate predictions to support better decision-making.

5. Objectives of the Study

The main objectives of this study are:

1. To analyze traditional methods used in interior design project estimation.
2. To collect and analyze historical interior design project data.
3. To develop an AI-based predictive model for cost and timeline estimation.
4. To improve the accuracy of project budget predictions.
5. To assist interior designers and project managers in better decision-making.
6. To evaluate the effectiveness of the predictive model.

6. Research Questions

The study aims to answer the following questions:

- What are the limitations of traditional estimation methods in interior design projects?
- How can historical project data be used to develop predictive models?
- Can AI-based predictive models improve cost estimation accuracy?
- What factors most influence the cost and timeline of interior design projects?
- How can AI-based predictions improve project planning and management?

7. Scope of the Study

This study focuses on developing a predictive model for estimating interior design project costs and timelines using AI techniques. The model analyzes factors such as:

- Project size
- Material costs
- Labor costs
- Design complexity
- Project duration

The research primarily focuses on residential and small commercial interior design projects. The predictive model aims to support designers and project managers in project planning and budgeting.

However, the study is limited to the available dataset and selected variables. External factors such as sudden economic changes or material price fluctuations may affect prediction accuracy.

8. Significance of the Study

This study is significant because it demonstrates how Artificial Intelligence can improve interior design project management. The predictive model can help designers and project managers make more accurate budget estimates and project plans.

The research benefits several stakeholders:

Interior Designers – by improving project planning and cost estimation.

Project Managers – by providing better resource management and scheduling insights.

Clients – by offering more accurate budgets and timelines.

Researchers – by contributing to the application of AI in the interior design industry.

The study also highlights the importance of adopting modern technologies to enhance efficiency in project management.

9. Research Methodology

The research methodology includes the following steps:

Data Collection

Historical data from previous interior design projects is collected. This data includes project size, material costs, labor costs, project duration, and design features.

Data Preprocessing

The collected data is cleaned and organized to remove errors and inconsistencies.

Model Development

Machine learning algorithms are used to develop a predictive model that can estimate project costs and timelines.

Model Training and Testing

The dataset is divided into training and testing sets to evaluate model accuracy.

Performance Evaluation

The model's predictions are compared with actual project outcomes to measure its effectiveness.

10. System Design

The AI predictive system includes the following components:

Input Data

Historical project data such as material cost, labor cost, and project area.

Data Processing Module

Processes and prepares data for analysis.

Machine Learning Model

Analyzes patterns and generates predictions.

Output Module

Provides predicted project budget and estimated timeline.

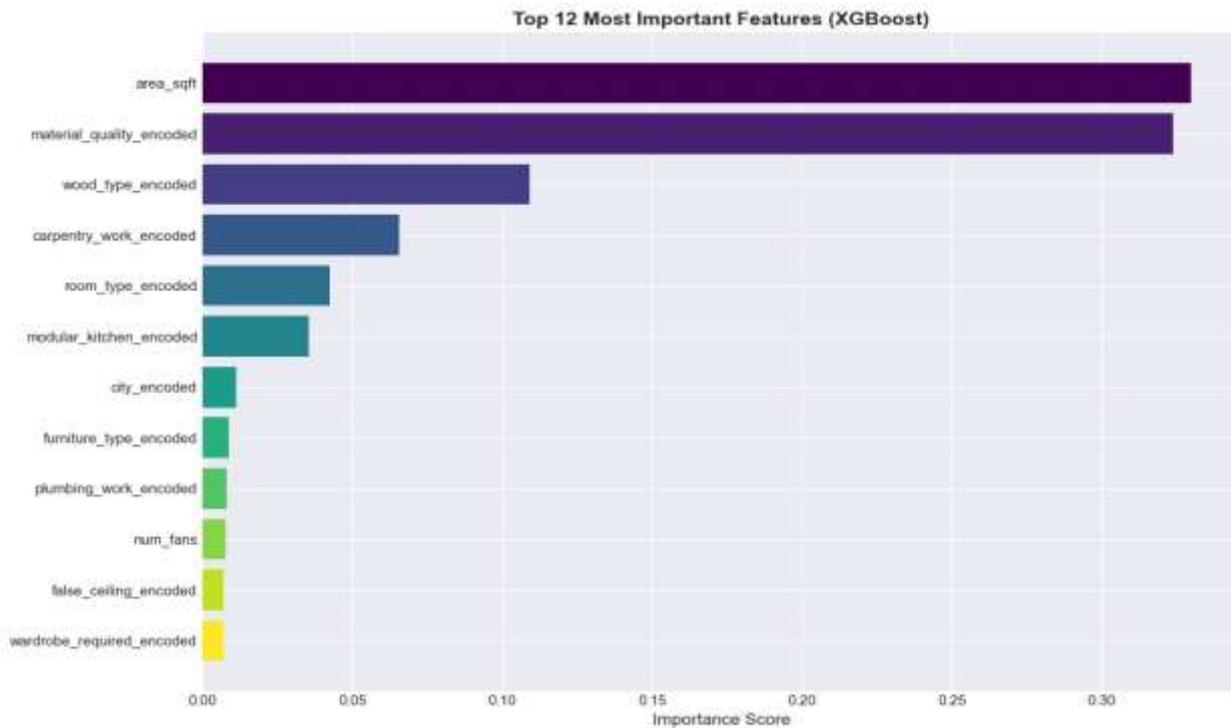
11. Results and Discussion

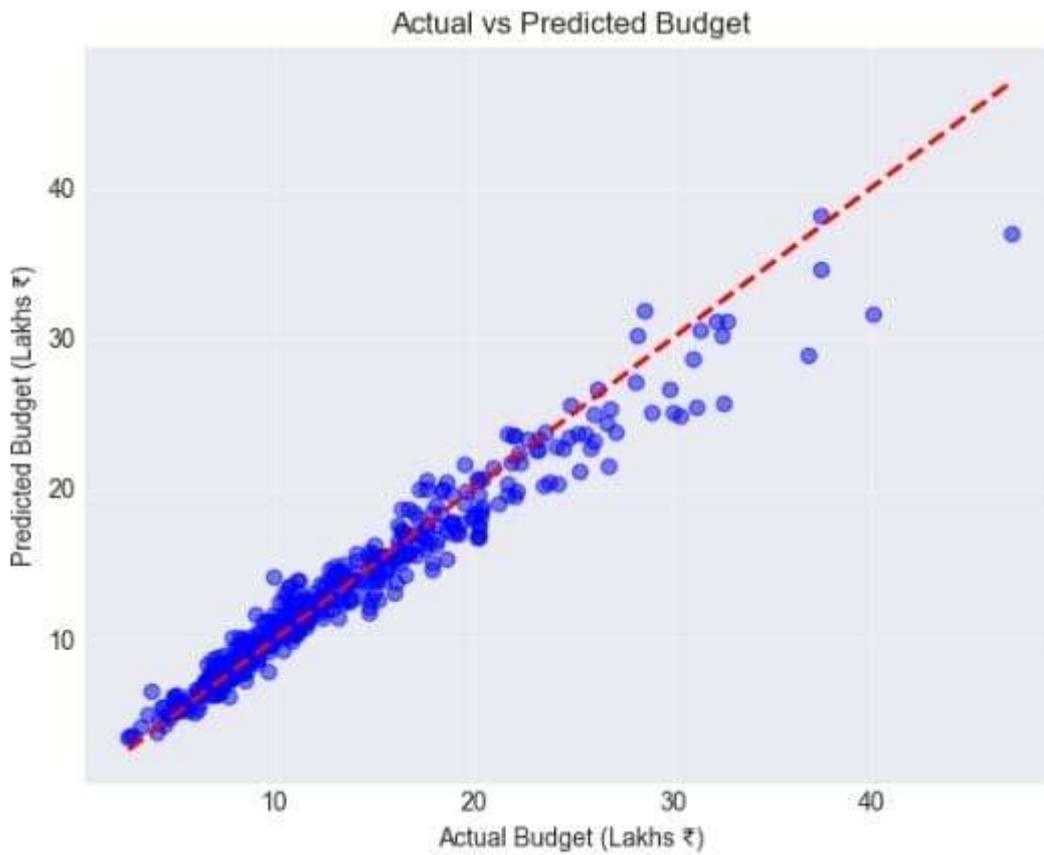
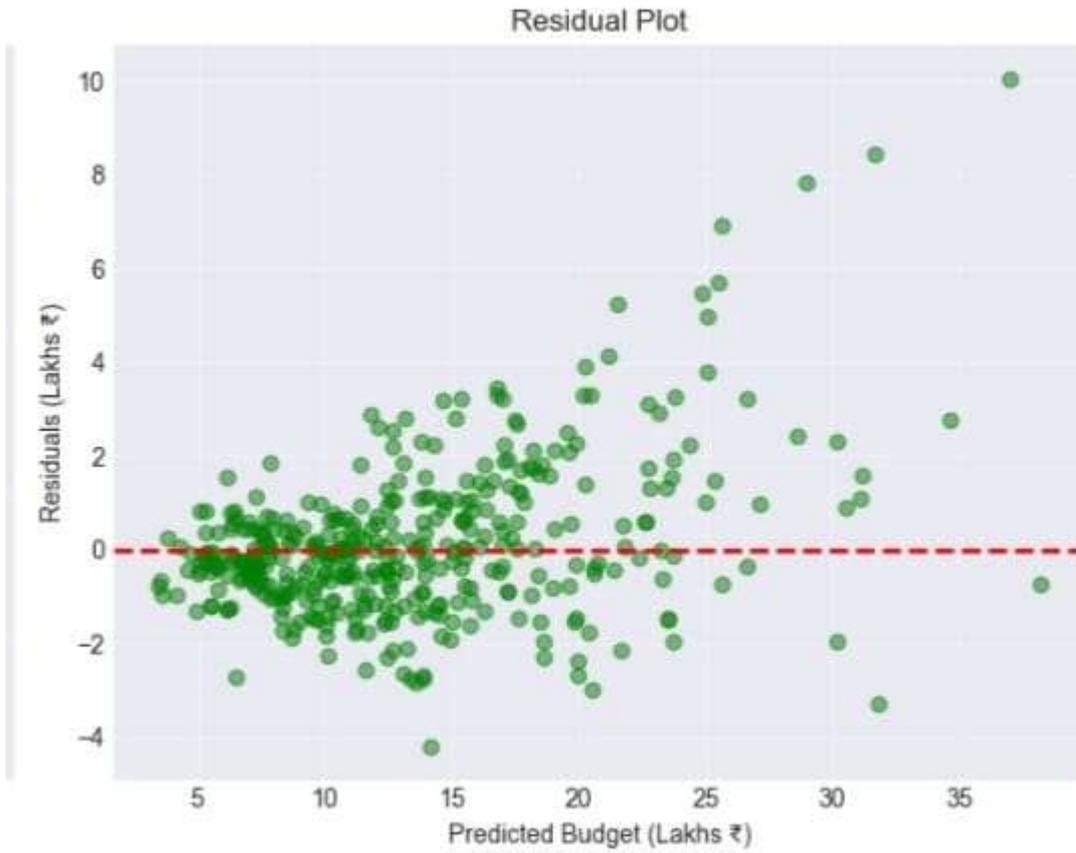
The developed AI-based predictive model successfully analyzes historical project data and generates cost and timeline predictions. The results show that the predictive model can improve estimation accuracy compared to traditional methods.

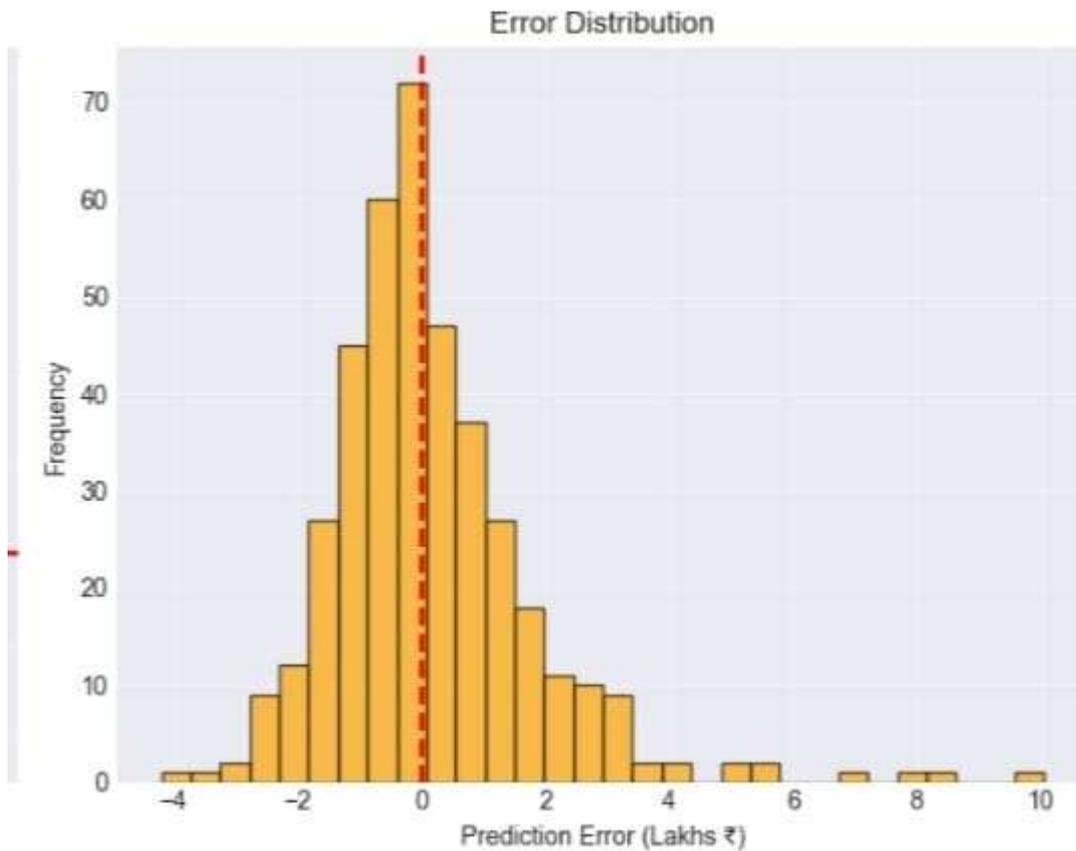
The system also helps identify key factors that influence project costs, such as material selection and project size.

However, prediction accuracy depends on the quality and quantity of available data.

12. Analysis of Result (Graphs)







14. Conclusion

This study demonstrates the potential of Artificial Intelligence in improving interior design project planning and management. The AI-based predictive model provides more accurate cost and timeline estimations compared to traditional methods.

The use of data-driven approaches can help interior designers and project managers make better decisions, reduce project risks, and improve overall project efficiency.

Future research can focus on integrating more advanced machine learning techniques and expanding the dataset to improve prediction accuracy.

15. Future Scope

Future improvements may include:

- Integration with interior design software tools
- Real-time material price tracking
- Advanced machine learning algorithms
- Cloud-based predictive systems
- Mobile applications for designers and project managers

16. References

- 1) J. Y. Deshmukh, P. Bhokare, P. Malunekar, A. Shenkar, and S. Thorat, "AI-Based Approach using Generative Adversarial Network for Interior Design System," *International Journal on Advanced Computer Engineering and Communication Technology*, vol. 14, no. 1, pp. 428–431, 2025.
- 2) D. Irwan, "AI-Driven Personalized Design: Adapting Building Interior Design Based on User Preferences," *International Journal of Artificial Intelligence Research*, vol. 9, no. 1.1, 2025.
- 3) M. Arbaba, M. Rahbar, and M. Arbaba, "A Comparative Study of Artificial Intelligence Models for Predicting Interior Illuminance," *Journal of Intelligent Systems*, pp. 373–392, 2021.
- 4) Z. Zhao, "Application of Artificial Intelligence in Modern Interior Design and its Impact on Design Efficiency," *Applied Mathematics and Nonlinear Sciences*, vol. 9, no. 1, 2024.
- 5) I. N. Albukhari, "The Role of Artificial Intelligence in Architectural Design: A Systematic Review of Emerging Technologies and Applications," *Journal of Umm Al-Qura University for Engineering and Architecture*, 2025.
- 6) B. H. S., U. Tabassum, D. N., S. S. Raju, D. Y., and M. N., "AI-Powered Virtual Interior Design," *International Journal of Innovative Research in Computer and Communication Engineering*, 2026.
- 7) Y. Liu and H. Wang, "Mental-Gen: A Brain-Computer Interface-Based Interactive Method for Interior Space Generative Design," *arXiv preprint*, 2024.
- 8) R. Gupta and A. H. Kyaw, "Insights-Informed Generative AI for Design: Incorporating Real-World Data for Text-to-Image Output," *arXiv preprint*, 2025.
- 9) M.-H. Le et al., "VIDES: Virtual Interior Design via Natural Language and Visual Guidance," *arXiv preprint*, 2023.
- 10) Y. C. Lin et al., "AIDED: Augmenting Interior Design with Human Experience Data for Designer-AI Co-Design," *arXiv preprint*, 2026.
- 11) X. Meng, Y. Zhang, Z. Chen, Y. Wang, P. Li, and B. Sheng, "Interior Decoration System using Virtual Reality and Artificial Intelligence," in *Proc. IEEE Virtual Reality and Visualization Conference*, 2018.
- 12) Z. Chen and X. Wang, "Application of Artificial Intelligence Technology in Interior Design," *E3S Web of Conferences*, vol. 179, 2020.
- 13) L. Boppana, M. Alekhya, M. Rishitha, C. Geethika, and S. Varsha, "AI RoomDecor: Intelligent Interior Decoration System," in *Proc. IEEE TENCON Conference*, 2024.
- 14) T. S. Ganesh, B. Narasimhulu, Y. V. Malika, P. R. Kumar, and D. Manasa, "AI-Driven Virtual Interior Designer," *International Journal of Innovative Research in Science, Engineering and Technology*, vol. 14, no. 6, 2025.
- 15) P. Merrell, E. Schkufza, Z. Li, M. Agrawala, and V. Koltun, "Interactive Furniture Layout Using Interior Design Guidelines," *ACM Transactions on Graphics*, vol. 30, no. 4, 2011.
- 16) Y. Yu, H. Zhang, and J. Xu, "Deep Learning Based Scene Understanding for Indoor Design Applications," *IEEE Access*, 2020.
- 17) C. Fu, X. Jia, and Y. Zhang, "Generative Design Methods in Architecture Using Artificial Intelligence," *Automation in Construction*, 2022.