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Wallify – Make walls talk, make vibes pop.

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Abstract: Interior wall decoration plays a crucial role in defining the aesthetic identity and emotional ambiance of indoor spaces. However, users often struggle not with visualization, but with *ideation*—deciding what to decorate, how to style it, and which combinations best suit their preferences and environment. This paper presents Wallify, an Artificial Intelligence- based interior decor ideation platform that assists users in generating personalized wall decor concepts based on contextual inputs such as user intent, style preferences, spatial characteristics, and mood. Instead of focusing primarily on augmented visualization, the system emphasizes intelligent recommendation and design reasoning by transforming user inputs into structured decor concepts, categorized themes, and curated layout suggestions. By integrating AI-driven recommendation models, design heuristics, and aesthetic analysis, Wallify acts as a digital decor advisor that simplifies decision-making, enhances creativity, and enables users to conceptualize cohesive interior designs efficiently.

Keywords: Augmented Reality, 3D Parallax Visualization, Interior Decoration, Event Decor, Artificial Intelligence, Computer Vision, Wall Detection, Image Processing, Personalized Recommendation System, Virtual Visualization, Smart Design Systems, True-Scale Calibration.

I. INTRODUCTION

Interior design is not merely about placing decorative elements but about creating meaningful, aesthetically coherent environments that reflect personality, purpose, and mood [1]. Among all elements, walls serve as the primary visual canvas in any indoor space. Despite the abundance of inspiration available online, users often face a critical challenge: transforming vague ideas into structured, actionable decor concepts [5].

Traditional approaches rely heavily on manual exploration—scrolling through inspiration platforms, referencing static images, or replicating existing designs. These methods lack personalization and fail to adapt to individual preferences, spatial constraints, or contextual intent [2]. As a result, users often experience decision fatigue, inconsistent styling, and inefficient planning [4].

This work redefines the problem by shifting focus from visualization to ideation. Instead of answering "How will this look?", the system answers "What should I create and why?" [3]

Wallify is proposed as an AI-powered interior decor ideation system that:
- Interprets open-ended user input instead of fixed categories [2]
- Converts user intent into structured design attributes [2]
- Generates categorized decor styles and themes [1][3]
- Suggests cohesive decor combinations and layouts [4]

By leveraging artificial intelligence and design reasoning, Wallify bridges the gap between abstract ideas and practical interior decor planning [5].

II. RELATED WORK

2.1 : Study on Event Organizing Platform

This paper presents a web-based event management system designed to simplify the process of organizing events by providing a centralized platform for users, vendors, and administrators. It enables users to select event details such as date, venue, and services, while facilitating communication with vendors and maintaining all data in a structured database. The system improves efficiency, transparency, and coordination in event planning, addressing challenges like vendor selection and service quality, and highlights the growing importance of digital solutions in managing complex event logistics. [1]

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2.2 : AI-Powered Event Planning Platform

This study introduces an AI-integrated event management system that automates various aspects of event planning, including venue booking, service selection, and scheduling. By incorporating features such as predictive analytics, recommendation systems, chatbots, and real-time data insights, the platform enhances user experience, reduces manual effort, and optimizes decision-making. The paper also discusses challenges like data privacy and implementation costs, while emphasizing the future potential of integrating advanced technologies such as AR/VR for more immersive and intelligent event management solutions. [2]

2.3 : Event Decoration with AR

This paper explores the application of augmented reality (AR) in event decoration, focusing on how AR enables users to visualize and customize decor elements in real-time within their actual environment. It highlights features such as virtual walkthroughs, interactive placement of decor items, and enhanced user engagement, which significantly improve planning accuracy and client satisfaction. The study demonstrates AR's potential to transform traditional decoration methods by offering immersive and dynamic design experiences, while also addressing challenges liketechnical complexity and device compatibility.[3]

2.4 : Implementation of Event Planner

This paper describes the development of a web-based event planning system that connects customers with event planners through a bidding mechanism. Users input their event requirements, and vendors respond with bids, allowing customers to choose based on pricing, ratings, and services. The system includes modules for registration, booking, availability checking, and reviews, making the process more efficient and cost- effective. It reduces manual effort, improves communication, and provides a structured approach to event
planning through automation and centralized data management.[4]

2.5 : Wallify (Proposed System)

The Wallify system proposes an AI and AR-based platform for personalized interior wall decoration, where users upload images of their walls and receive tailored decor suggestions based on event type, color preferences, and style. Using computer vision techniques like wall detection and segmentation, along with AI- driven recommendation engines, the system overlays virtual decor elements onto the user's space for real-time visualization and customization. This approach addresses the key limitation of traditional decor planning: lack of visualization: by enabling interactive design, improved decision-making, and a more immersive user experience design platform. [5]

2.6 Comparison

Table-1: Comparison against trial work

Paper / System	Core Focus	Technologies Used	Key Features	Limitations	Relevance to Wallify
Study on Event Organizing Platform [1]	Web-based event management	Web apps, database systems	Vendor coordination, booking, centralized platform	No AI, no visualization, limited personalization	Provides base idea of centralized planning
AI-Powered Event Planning Platform [2]	Intelligent event management	AI/ML, predictive analytics, chatbots	Automation, recommendations, personalization	Lacks visual preview (no AR), high complexity	Introduces AI-driven recommendations
Event Decoration with AR [3]	AR-based decor visualization	Augmented Reality, 3D rendering	Real-time preview, interactive design	Limited AI, no personalization logic	Strong foundation for AR visualization
Implementation of Event Planner [4]	Vendor-customer interaction system	Web-based system, MySQL	Bidding system, reviews, booking	No AI, no AR, manual decision-making	Useful for vendor integration ideas

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III. ARCHITECTURE AND LAYOUT

A. Frontend Layer:

The frontend serves as the user interface of the system, allowing users to upload or capture an image of their wall and specify preferences such as event type, color scheme, and design style. It also provides interactive features for editing, including drag-and-drop placement, resizing, and customization of decor elements. The interface is designed to be intuitive and responsive, ensuring a smooth user experience.

B. Backend Layer:

The backend is responsible for processing user inputs and performing core computations. It includes a wall detection and segmentation module using computer vision techniques such as OpenCV or YOLO to identify the wall region accurately. Additionally, a recommendation engine generates decor suggestions based on user preferences using rule-based logic or machine learning models. The backend also manages data storage for decor assets and user configurations.

C. Output Layer:

The output layer generates the final decorated wall visualization by overlaying recommended decor elements onto the detected wall area. This is achieved using rendering technologies such as Three.js or AR frameworks. The system produces a realistic preview that users can download, share, or use as a reference for implementation, along with an optional list of suggested decor items.

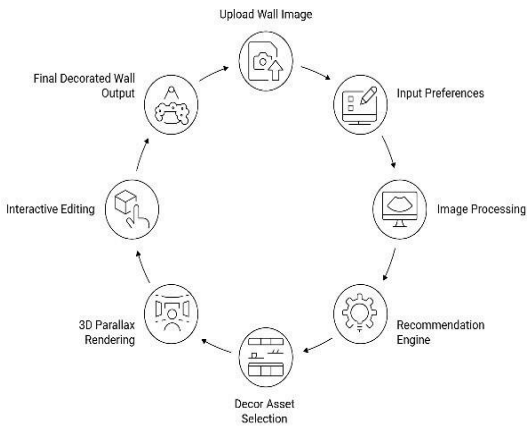

Fig-1: Working flowchart

IV. METHODOLOGY

The Wallify architecture is a distributed system consisting of a Python/Flask backend for intelligent processing and an HTML5/Canvas frontend for real- time manipulation.

A. Machine Learning Recommendation System

To solve the "blank canvas" problem, Wallify utilizes a Random Forest Classifier to suggest initial layouts. [2][5]

i. Feature Vectorization: The system identifies three primary categorical features: *Event Type* (e.g., Wedding, Corporate, Birthday), *Color Scheme* (e.g., Pastel, Neon, Classic), and *Budget* (Low, Medium, High).
ii. NLP Integration: To streamline the user experience, an NLP module parses raw user text inputs. If a user types "I want a cozy, low-budget birthday setup," the module extracts the relevant tags to populate the feature vector.
iii. Predictive Modelling: The Random Forest model, chosen for its high accuracy with categorical data and resistance to overfitting, predicts the optimal decoration category (e.g., "Wall-flush fringes" vs. "Voluminous arches").

B. Computer Vision Compositing

Unlike traditional 2D editors, Wallify treats the image as a multi-layered spatial environment through Z-depth stratification [3][5]:

- Layer 0 (Background): The static base image.
- Layer 1 (Midground): Items physically flush with the wall, such as fairy lights or banners.
- Layer 3(Foreground): High-depth objects that protrude into the room.

To bridge the visual gap between 2D and 3D, the engine applies Ambient Occlusion Simulation [3]. By calculating the alpha channel of Z_2 assets and applying a Gaussian-blurred offset based on a virtual light source vector, the system creates localized drop-shadows. This visual cue provides the user with an intuitive sense of how much space an object occupies [5].

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C. *The True-Scale Calibration Algorithm* This is the core computational novelty of the framework. To map a 2D pixel space to a 3D physical space, the system requires a scalar reference [3][5].

1. Reference Definition: The user identifies a known object in the photo (e.g., a door frame or a 12-inch tile) and draws a reference vector AB

2. Pixel Distance Calculation:

The Euclidean distance is calculated:

$$D = \sqrt{(B_1 - A_1)^2 + (B_2 - A_2)^2}$$

3. Scaling Ratio Determination: Given the real-world length (L_{real}), the system calculates the universal scaling ratio:

$$\kappa = \frac{D_{px}}{L_{real}}$$

4. Real-Time HUD Projection: Any asset I placed on the canvas with a pixel width $W_{i,px}$ is dynamically converted to its real-world dimension $W_{i,real} = W_{i,px}/R$. Thisis displayed in a real-time Heads-Up Display (HUD) as the user resizes the asset.

V. IMPLEMENTATION OUTPUT

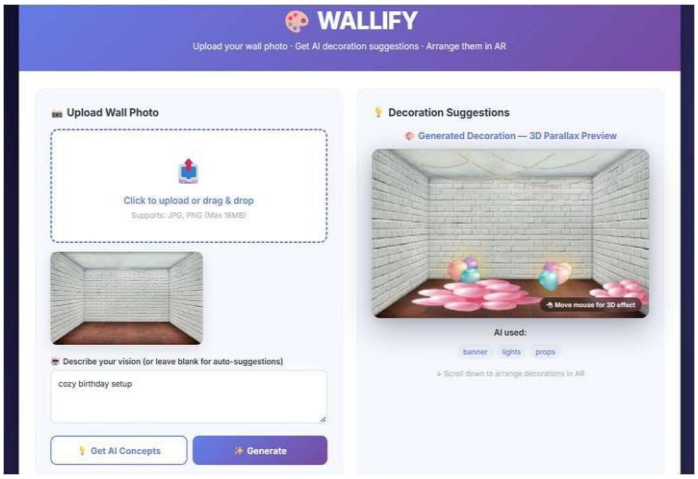

Fig-2: Implementation_output-1

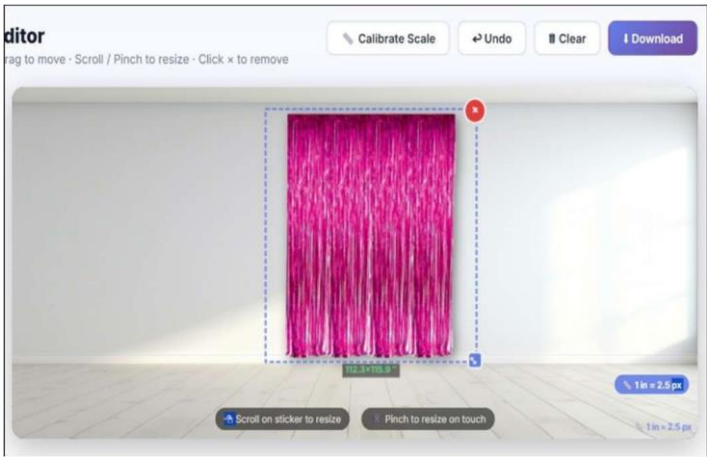

Fig-3: Implementation_output-2

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VI. FUTURE WORK

The system can be enhanced by integrating advanced AI models for more accurate and personalized decor recommendations, along with improved wall detection using deep learning for complex environments [2][3]. The 3D parallax module can be extended to more realistic depth and lighting effects [3]. Future work may also include integration with e- commerce platforms for direct purchasing, addition of collaborative and voice-based features, and optimization for mobile platforms to improve scalability and user accessibility [1][5].

VII. CONCLUSION

This work presents a novel approach to interior wall decoration by integrating artificial intelligence with 3D parallax visualization to provide personalized and interactive design solutions [2][3]. By allowing users to upload images of their walls and receive tailored decor suggestions, the system effectively addresses the key challenge of visualizing decor before implementation [5]. The use of computer vision techniques for accurate wall detection, combined with a recommendation engine based on user preferences, ensures that the generated designs are both relevant and adaptable [2].

The inclusion of an interactive interface further enhances user engagement by enabling real- time customization of decor elements [1].

Furthermore, the adoption of 3D parallax visualization offers a realistic depth-based representation of decor layouts, improving user understanding of spatial arrangements compared to traditional 2D previews [3]. The system not only simplifies the decoration process but also supports better decision- making by reducing trial-and-error efforts [4]. Overall, the proposed solution bridges the gap between imagination and execution, providing a scalable and user-centric platform for intelligent interior design [5]. With future enhancements, it holds strong potential for application in event planning, home decor, and commercial design domains [1][2].

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