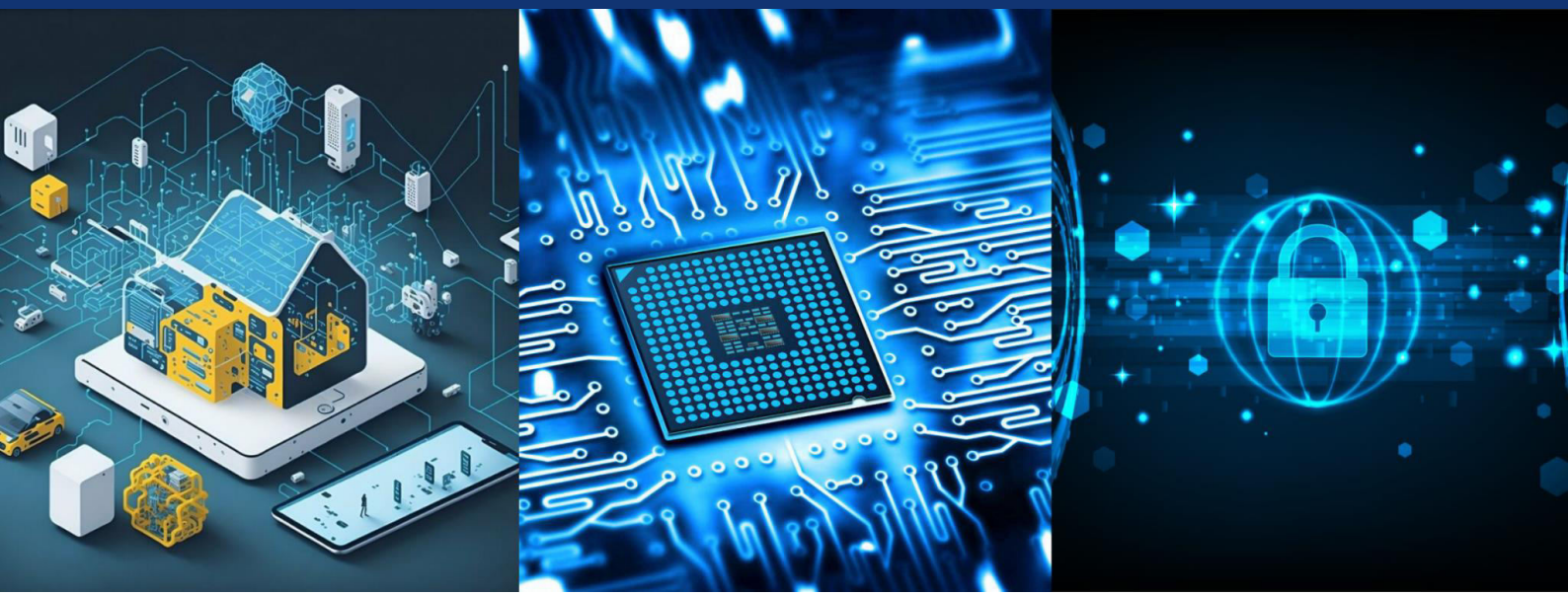
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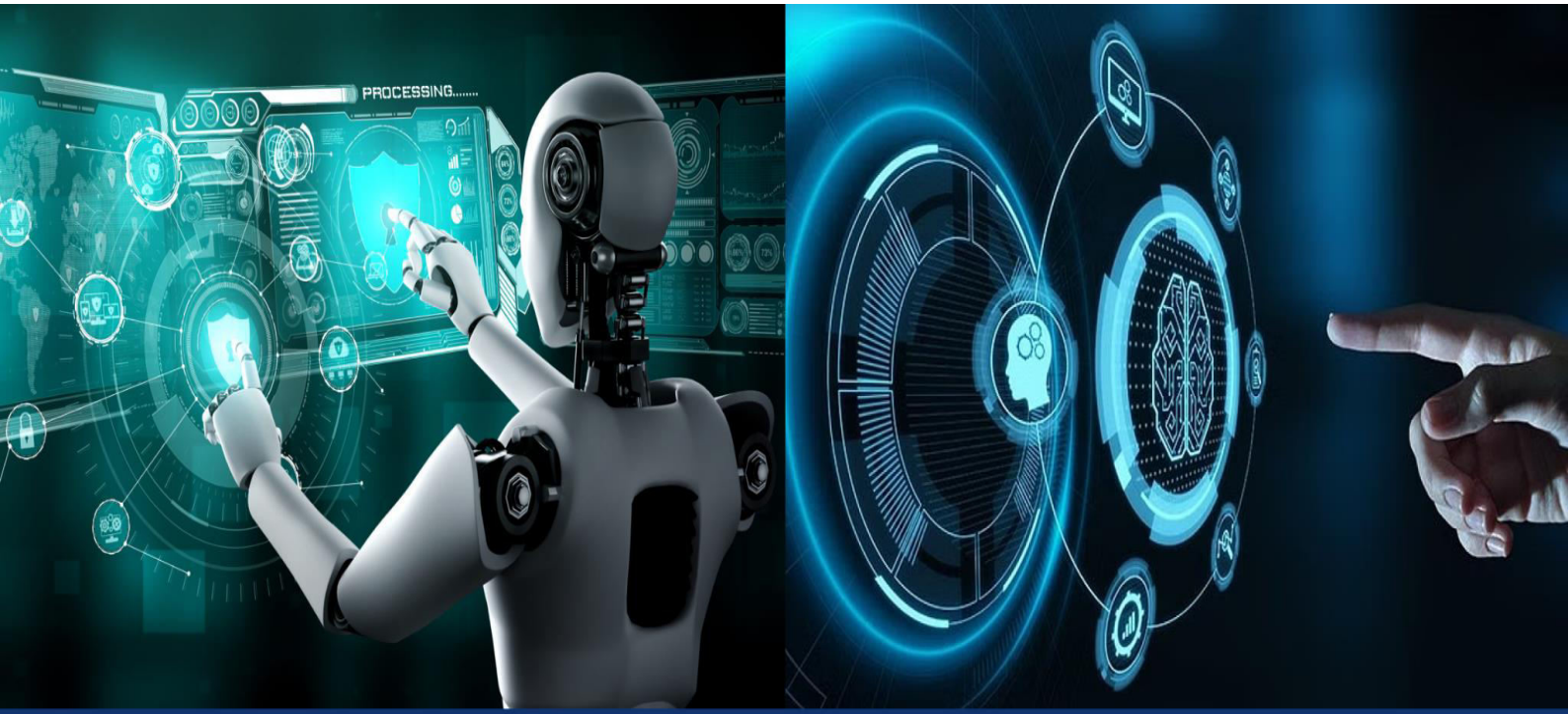
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Generative AI-Based Interior Design System Using an Android Application and Cloud-Based Image Generation

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ABSTRACT: Interior design visualization can be difficult for users who lack design experience. This paper presents Interior AI Studio, an Android application that generates interior-design images from user preferences. Users select a room type, interior style, colour palette, and optionally provide a room photograph. A Python FastAPI backend processes the request, communicates with the configured Cloudflare AI image-generation service, and returns the generated image to the application. The project integrates mobile interaction, backend request handling, and cloud-based image generation. The system supports early-stage design exploration; its outputs require human review and are not substitutes for accurate measurements or professional construction advice.

KEYWORDS: Generative AI, interior design, Android application, FastAPI, image generation.

I. INTRODUCTION

Interior design involves arranging and decorating indoor spaces to improve their appearance, comfort, and functionality. Developing a design concept requires decisions about furniture placement, colour combinations, lighting, wall finishes, and decorative elements. Designers and clients may review several alternatives before settling on a preferred concept. For people without design experience, it can be difficult to imagine a room's final appearance from a written description or a basic drawing.

Generative artificial intelligence (AI) offers a way to explore visual alternatives from text instructions and reference inputs. Text-to-image services can produce illustrative concepts that help users compare styles and communicate preferences. However, generated images should be treated as visual proposals: they may not preserve exact dimensions, building constraints, product availability, or construction feasibility.

This paper presents Interior AI Studio, an Android application connected to a Python FastAPI backend and a configured Cloudflare AI image-generation service. The system accepts design preferences, sends a request for image generation, and displays the returned design in the mobile application. The objective is to make early-stage interior visualization more accessible while maintaining a modular architecture.

II. LITERATURE SURVEY

Prior research has explored AI tools for producing alternative interior-space concepts and assisting designers during early visualization. Sonpol and Khalifa discuss AI-based design alternatives and highlight the continuing importance of human judgement when assessing practicality and suitability [1]. Research on intelligent interior design has also examined generative models, including GAN-based methods, for creating interior scenes with varied visual characteristics and object arrangements [2].

ControlNet introduces additional structural conditioning for text-to-image diffusion models, using inputs such as edge, depth, or segmentation information to guide image generation [3]. These approaches are relevant to interior design because spatial layout and object placement affect the usefulness of generated images. The current Interior AI Studio project focuses on integrating a mobile interface, a backend API, and an image-generation service. More explicit spatial control is a potential extension, not a capability claimed for the current version.

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III. METHODOLOGY / APPROACH

A. System Architecture

The system follows a client–backend–AI-service structure. The Android application collects the room type, preferred design style, colour palette, optional descriptive details, and optional reference photograph. It sends the design request to the Python FastAPI backend through an API call. The backend validates and processes the request, prepares a prompt for image generation, and sends it to the configured Cloudflare AI service. The generated image or its accessible reference is returned to the backend and then to the Android application for display.

This separation of components helps isolate mobile-interface changes from backend processing and external-service integration. The backend must be reachable from the device running the application. An emulator-specific address such as 10.0.2.2 is intended for emulator-to-host communication and should not be used as the public server address on a physical phone. Deployment outside a local development environment requires a reachable server address and appropriately secured HTTPS access.

B. Application Workflow

1) The user opens Interior AI Studio and selects a room type, such as a living room or bedroom.
2) The user chooses an interior style and colour palette and may add a short design description.
3) The user may select a room photograph from the device gallery as a reference for redesign.
4) The Android application submits the selected options and relevant image data to the FastAPI backend.
5) The backend prepares the image-generation request and communicates with the configured AI service.
6) The generated image or its reference is returned through the backend and displayed in the application.
7) The user reviews the result and can change preferences and submit another request to explore a different concept.

C. Implementation Details

The mobile application is developed for Android using Android Studio and the Android SDK. Its interface presents room and style choices, colour-palette options, an optional gallery-photo selection, a generation action, and a view for the returned image. The backend is implemented in Python with FastAPI and is run through Uvicorn during development. Cloudflare AI is used as the configured image-generation service. This architecture allows the Android device to request generated imagery without running the generative model locally.

Network configuration is important for deployment. A development server running on a laptop can be accessed by an emulator through the emulator's host gateway, but a physical phone requires a server address reachable over the local network or internet. API credentials should remain on the backend and should not be embedded in a publicly distributed APK. Production deployment should use HTTPS, appropriate access controls, request limits, and clear handling of service failures.

IV. RESULTS AND DISCUSSION

The project report describes the application interface and the workflow for selecting a room type, interior style, colour palette, and optional reference photograph; submitting an image-generation request; and displaying the generated interior design. The report also identifies functional testing areas including application launch, input selection, photo upload, backend connectivity, image generation, output display, and error handling.

Integration testing is important because the workflow crosses three components: the Android client, the FastAPI backend, and the AI image-generation service. Additional checks should cover incomplete inputs, interrupted network connections, unavailable backend services, unsuccessful generation requests, and repeated generation attempts. Usability checks can examine whether users understand the available choices and whether loading and error messages explain the current status.

The supplied report does not provide a labelled test dataset, measured response-time series, participant counts, or numerical benchmark results. Therefore, this paper does not claim a specific success rate, accuracy score, or quantified reduction in design time. A reproducible evaluation should record device and network conditions, the number and types of prompts tested, successful and failed requests, response times, and a documented rubric for image relevance and visual quality.

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The system can help users explore design alternatives without manually creating every visual concept. Its usefulness depends on prompt clarity, model capabilities and availability, reference-image quality, and network conditions. Generated images can contain inconsistent geometry, inaccurate dimensions, or details that are difficult to implement in a real room. Users should treat the results as inspiration and seek professional advice for measurements, structural requirements, accessibility, electrical planning, and construction decisions.

V. CONCLUSION

This paper presented Interior AI Studio, an Android-based generative-AI interior visualization system integrated with a Python FastAPI backend and a configured Cloudflare AI image-generation service. Users can specify room and style preferences, choose a colour palette, optionally provide a room photograph, and request an illustrative interior design image. The backend mediates communication with the image-generation service and returns the result for display in the mobile application.

The project demonstrates a practical architecture for making AI-generated interior concepts accessible through a mobile interface. Its output can support early creative exploration but should not replace accurate measurements, technical planning, or professional review. Future work should document repeatable tests and measured results, improve control over spatial arrangements, and evaluate generated concepts with users.

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