

Smart Ads-Smart Ads for Smart City

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Abstract: Traditional advertising methods, such as paper posters, banners, and hoardings, require manual design, printing, installation, and maintenance. These activities increase operational effort, material consumption, and the difficulty of updating advertisements. This paper presents SmartAds, a web-based artificial intelligence-powered digital advertisement management platform developed to simplify advertisement creation, pricing, payment-record management, approval, scheduling, and display. The system enables users to generate promotional descriptions and slogans from product details using large language model services. A fallback mechanism involving Groq, an optional local Ollama model, and rule-based generation supports content creation when an AI service is unavailable. Users can select poster or video formats, choose display slots, calculate advertisement costs, and track their submissions. Administrators can approve or reject advertisements before they are scheduled for display. The platform also includes payment-record management, receipt generation, notifications, optional AI avatar-video generation through D-ID, and a browser-based virtual LED display. SmartAds was implemented using Python, Flask, SQLAlchemy, HTML, Bootstrap, and JavaScript. Functional testing documented in the project report covered 45 test cases, all reported as passing. The system demonstrates the feasibility of integrating AI-assisted content generation with digital advertisement workflow management in a controlled proof-of-concept environment.

Key Words: Smart Ads; Artificial Intelligence; Digital Advertising; Smart Cities; Advertisement Management; Large Language Models; Virtual LED Display .

I. INTRODUCTION

Digital advertising is increasingly recognized as an important component of communication and business promotion in smart cities. This is mainly attributed to the growing demand for effective, flexible, and accessible advertising methods that can reach target audiences with relevant promotional information. Traditional advertising methods, such as printed posters, banners, and hoardings, require manual designing, printing, installation, and maintenance, which can increase operational costs, material consumption, and the time required to update advertisements. Numerous businesses, particularly small and medium-sized enterprises, may also face difficulties in creating attractive advertising content and managing advertisement campaigns efficiently. Thus, improving the efficiency of advertisement creation and management is an important objective of digital advertising systems. Artificial intelligence (AI) and large language models provide opportunities to generate promotional descriptions and slogans from basic product information, while digital display technologies enable advertisements to be scheduled and updated electronically. However, advertisement generation, pricing, payment management, administrative approval, and display scheduling are often handled as separate activities. An integrated system can simplify these processes and improve the overall management of digital advertisements. The present study aims to develop SmartAds, an AI-powered digital advertisement management system that integrates automated advertisement content generation, dynamic pricing, payment-record management, administrative approval, scheduling, notifications, and virtual LED display. The system is designed to reduce manual effort and demonstrate an organized approach to digital advertisement management in a smart-city environment.

II.SCOPE OF THE PROJECT

The scope of the SmartAds project is to develop a web-based, AI-powered digital advertisement management system that simplifies the process of creating, managing, and displaying advertisements. The system supports AI-assisted generation of promotional descriptions and slogans using product information. It provides poster and video advertisement options, display-slot selection, dynamic price calculation, payment-record management, administrative approval, scheduling, notifications, and receipt generation. The platform also includes a virtual LED display to demonstrate the presentation of approved advertisements according to their schedules. An optional AI avatar-video generation feature is supported through D-ID integration. The project focuses on integrating these functions into a centralized application and demonstrating their operation in a controlled software environment.

III.EXISTING SYSTEM AND PROPOSED SYSTEM

Existing System: Traditional advertising systems primarily depend on printed posters, banners, and hoardings, which require manual content preparation, printing, installation, and maintenance. Updating promotional information may involve replacing existing materials, increasing operational effort and material consumption. Advertisement design, pricing, payment tracking, approval, and scheduling may also be managed separately, resulting in additional coordination and delays. Small businesses may

experience difficulties in preparing promotional content and managing advertising activities efficiently. These limitations indicate the need for a centralized digital solution that supports advertisement creation and management with reduced manual intervention. **Proposed System:** The proposed SmartAds system integrates AI-assisted advertisement generation and digital advertisement management through a web-based platform. Users can enter product details and generate promotional descriptions and slogans using the Groq API, with an optional local Ollama model and rule-based generation as fallback mechanisms. Users can select poster or video formats, choose display slots, and calculate advertisement costs based on configured pricing parameters. The system supports payment-record management, receipt generation, and advertisement-status tracking. Administrators can review submitted advertisements and approve or reject them before scheduling. Notifications communicate relevant status changes, while the virtual LED display demonstrates the presentation of eligible advertisements. The system also provides an optional D-ID integration for AI avatar-video generation

IV.SYSTEM DESIGN

System design: SmartAds follows a modular, layered architecture consisting of a presentation layer, an application layer, and a data layer. These layers interact to support the advertisement management workflow.

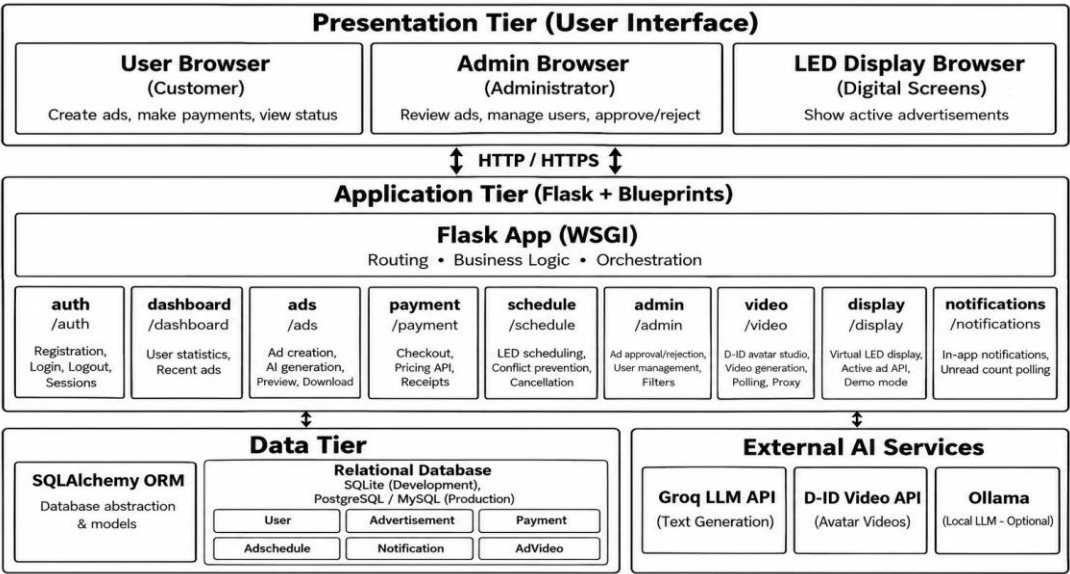


Figure no 1: System Design

1. **Presentation Layer:** The presentation layer provides the user dashboard, advertisement creation interface, administrator dashboard, and virtual LED display. It is developed using HTML, CSS, Bootstrap, JavaScript, and Jinja2 templates. Users can submit product information, configure advertisements, view prices, and track their submissions. Administrators can access advertisement review and management functions.
2. **Application Layer:** The application layer is implemented using Python and Flask. It handles authentication, advertisement creation, AI-based content generation, pricing calculations, payment-record management, administrative approval, scheduling, receipt generation, and notifications. Separate modules support the main functions, improving the organization and maintainability of the application.
3. **AI Integration Module:** This module generates promotional descriptions and slogans from user-provided product information. It first attempts to use the Groq API, with an optional Ollama local model and rule-based templates as fallback mechanisms. The optional D-ID integration supports AI avatar-video generation.
4. **Database Layer:** SQLAlchemy ORM manages database operations, with SQLite used in the project implementation. The database stores relevant user information, advertisement details, scheduling information, payment records, and status information required by the application.
5. **Pricing and Payment Module:** This module calculates the advertisement cost using configured pricing parameters and applicable taxes. It records payment-related information and supports receipt generation and payment-history viewing. The implemented payment workflow is intended for project demonstration and should not be interpreted as a verified live payment-gateway integration.
6. **Approval and Scheduling Module:** Administrators review submitted advertisements and approve or reject them. Approved advertisements can be associated with display schedules, allowing the system to determine which advertisements are eligible for presentation.
7. **Virtual Display Module:** The virtual LED display retrieves eligible advertisements and presents them through a browser-based interface. This module demonstrates the scheduled advertisement-display workflow without requiring physical LED display hardware.
8. The complete workflow begins with user authentication and advertisement creation. The system generates promotional content, calculates the price, and records payment-related information. The advertisement is then submitted for administrative review. Following approval, it can be scheduled and presented through the virtual LED display.

9. Notifications communicate relevant updates throughout the workflow.

The system was developed using Python, Flask, SQLAlchemy, SQLite, HTML, Bootstrap, JavaScript, and integrated external AI services. Functional testing was conducted on the implemented modules to evaluate their expected behavior.

V.RESULT

The implemented SmartAds application integrates the main stages of advertisement management in a single web-based environment. The user dashboard provides an overview of advertisements, approval status, spending, and active schedules. Users can enter product information and request AI-generated promotional descriptions and slogans.

The fallback content-generation mechanism provides an alternative when the primary AI service cannot be accessed. The format and slot selection modules allow users to configure advertisements, while the pricing engine calculates charges from configured rates and multipliers. Users can enter product information and request AI-generated promotional descriptions and slogans. The fallback content-generation mechanism provides an alternative when the primary AI service cannot be accessed. The format and slot selection modules allow users to configure advertisements, while the pricing engine calculates charges from configured rates and multipliers. The payment module records transactions and supports receipt generation. The administrator interface supports advertisement review, approval, rejection, and user management. The scheduling module associates approved advertisements with display periods, and the virtual LED interface demonstrates the presentation of eligible advertisements. Notifications communicate relevant status changes. The optional video module supports integration with the D-ID service.

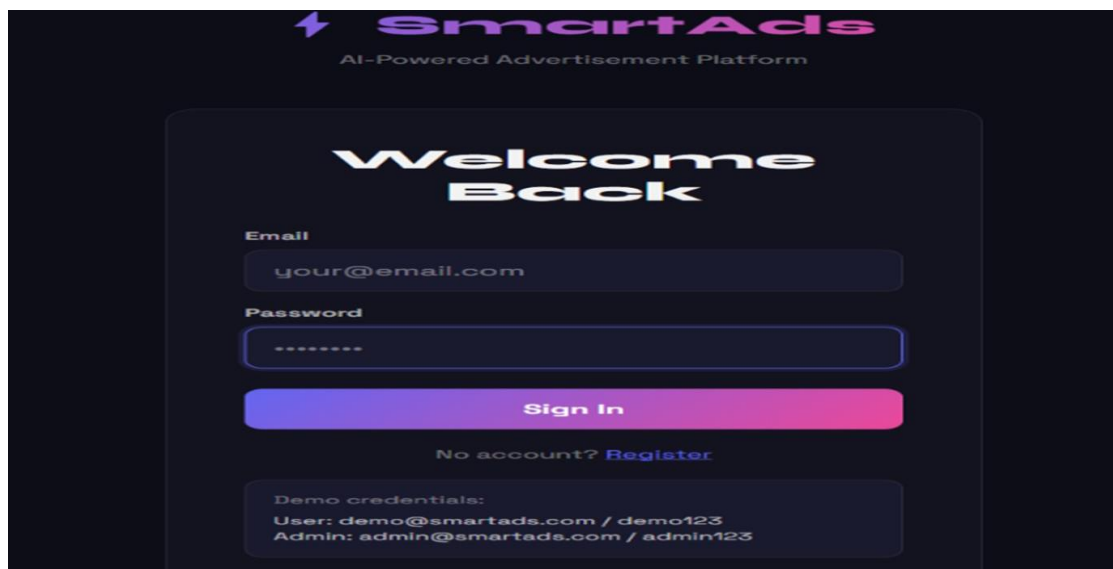


Figure no 1: login page

The SmartAds login page allows registered users and administrators to securely access the platform using their email and password. It provides registration options and demo credentials for testing the system.

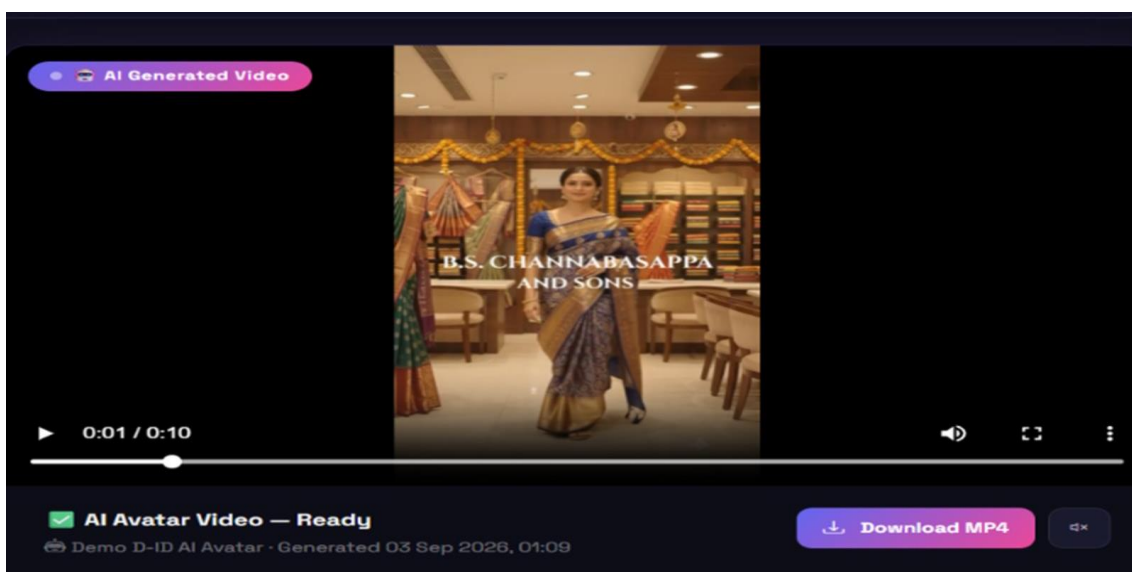


Figure no 2: D-ID Avatar Video Studio

This module uses AI avatar technology to create engaging advertisement videos for products and businesses. Users can generate promotional videos, preview the generated content, and download the final video in MP4 format for advertising purposes.

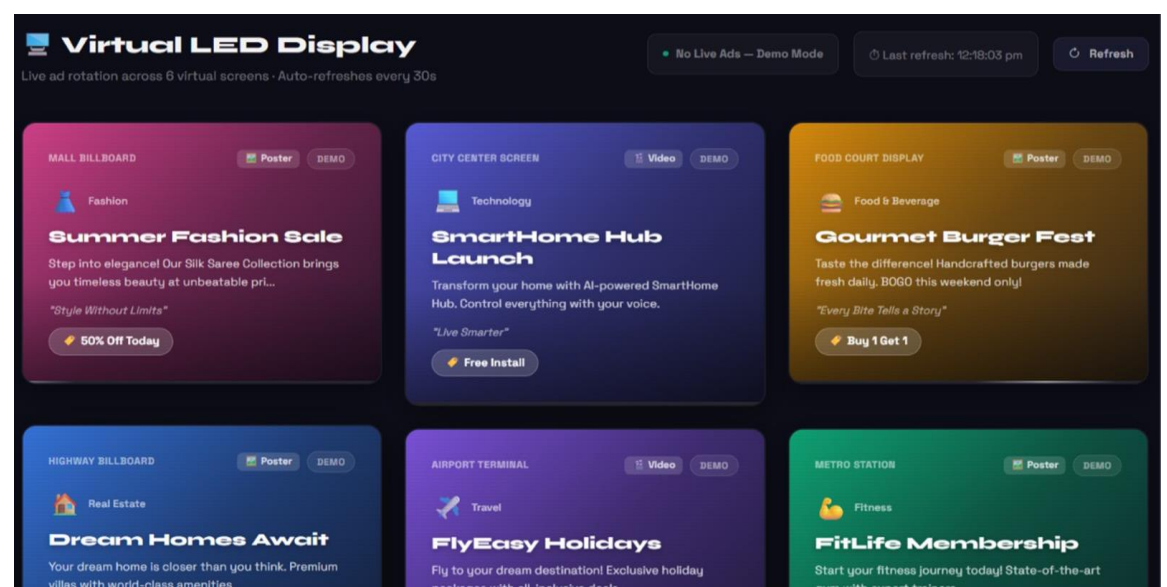


Figure no 3: Virtual LED Display

This module uses AI avatar technology to create engaging advertisement videos for products and businesses. Users can generate promotional videos, preview the generated content, and download the final video in MP4 format for advertising purposes.

The screenshot shows a dashboard titled "My Advertisements" with a "+ Create Ad" button in the top right. Below the title is a table with columns: AD, FORMAT, LOCATION, AMOUNT, STATUS, DATE, and ACTIONS. The table contains seven rows of advertisement data.

AD	FORMAT	LOCATION	AMOUNT	STATUS	DATE	ACTIONS
silk saree Fashion	Poster	Mall Billboard	₹472	pending	23 Sep 2026	Preview, Download, Edit, Delete
Shantala — 50% off Fashion	Poster	Mall Billboard	₹13216	approved	04 Sep 2026	Preview, Download, Edit, Delete
BSC — 50% off Fashion	Poster	Mall Billboard	₹944	pending	04 Sep 2026	Preview, Download, Edit, Delete
silk saree — 50% off Fashion	Poster	Mall Billboard	₹5664	pending	04 Sep 2026	Preview, Download, Edit, Delete
Gourmet Burger Special Food & Beverage	Poster	Food Court Display	₹500	pending	21 Aug 2026	Preview, Download, Edit, Delete
Tech Gadgets Launch Technology	Video	City Center Screen	₹1200	approved	19 Aug 2026	Preview, Download, Edit, Delete
Summer Sale Bonanza Fashion	Poster	Mall Billboard	₹500	approved	17 Aug 2026	Preview, Download, Edit, Delete

Figure no 4: My Ads List

Provides a centralized dashboard to manage advertisements, including their format, display location, cost, date, and approval status. Users can create new ads, preview advertisements, download files, and track whether their ads are pending or approved.

VLDISCUSSION

SmartAds integrates functions that are often handled as separate activities in an advertising workflow. By combining AI-assisted content creation with pricing, payment-record management, approval, scheduling, and virtual display, the platform provides a centralized approach to digital advertisement management.

The AI content-generation mechanism is a key feature of the system. Users can provide basic product information rather than preparing all promotional text manually. The fallback sequence involving Groq, Ollama, and rule-based templates also reduces dependence on a single generation service. However, generated content still requires review to ensure accuracy, relevance, and suitability before publication.

The configurable pricing engine supports cost calculation according to location, format, display slot, duration, and applicable tax. Administrative moderation introduces a review stage before an advertisement becomes eligible for display. Scheduling and virtual display then demonstrate the transition from approved content to electronic presentation.

The virtual LED interface is particularly useful for demonstrating the proposed workflow without requiring physical display infrastructure. Nevertheless, simulated display cannot fully reproduce the network, hardware, and operational constraints of a real digital signage deployment. Similarly, the payment module demonstrates transaction-record management rather than

verified live payment processing.

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The system has several limitations. The current implementation is a proof of concept, and further work is needed to assess usability, security, reliability, and performance under realistic workloads. Integration with physical LED displays, production payment services, scalable cloud infrastructure, and advanced campaign analytics would be required for wider deployment.

VII.CONCLUSION

SmartAds is an AI-powered digital advertisement management platform integrating advertisement generation, dynamic pricing, payment management, approval, scheduling, notifications, and virtual LED display. It uses a modular Flask architecture with AI-based content generation and fallback mechanisms. Functional testing covered 45 test cases, all reported as passing in the project report. The system demonstrates the feasibility of centralized digital advertisement management in a smart-city environment. Future work includes physical LED integration, live payment gateways, security improvements, and real-world evaluation.

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