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A Workflow-Oriented Architecture Integrating Large Language Models for Automated Multi-Platform Content Management

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ABSTRACT

The rapid growth of social media platforms has significantly increased the complexity of managing digital content across multiple channels. Organizations and content creators increasingly require automated systems that can coordinate publishing, interaction handling, and contextual response generation across heterogeneous platforms. Existing content management tools often provide limited workflow integration and insufficient support for intelligent interaction management. This study proposes a workflow-oriented architecture for automated multi-platform content management that integrates large language models (LLMs) with workflow automation mechanisms. The proposed system is built upon a unified conceptual framework termed CLAW (Content–LLM–Automation–Workflow), which coordinates content resources, contextual information, AI-based response generation, and workflow orchestration within a single operational structure. The architecture combines centralized backend services, workflow automation, and LLM-based contextual interaction capabilities to support synchronized publishing, multi-account management, and automated response handling across social media platforms. A functional prototype was implemented to demonstrate the feasibility of the proposed architecture. The results show that integrating LLM-based contextual reasoning with workflow orchestration enables more coherent, scalable, and adaptive content management operations. The proposed system provides a practical foundation for future research and development of AI-enabled multi-platform content management systems.

1. INTRODUCTION

In the context of global digital transformation, the rapid expansion of social media platforms such as globally popular Facebook (https://www.facebook.com/), Instagram (https://www.instagram.com/), Twitter which has recently been renamed as X (https://x.com/), Telegram (https://web.telegram.org), and Vietnamese widely-used Zalo (https://chat.zalo.me/) has created a dynamic digital communication environment in which users simultaneously act as consumers, producers, and distributors of content. This transformation has led to a substantial increase in digital content creation and interaction across platforms.

Figure 1 illustrates the long-term growth trend of social media usage over recent years (data from Statistica summarized by Dodokh [1]). This expansion has been accompanied by a corresponding rise in digital content volume, which poses increasing challenges for online content management and automation, particularly for enterprises, media agencies, and independent content creators operating across multiple platforms.

Current multi-platform content management practices face several limitations. While widely adopted tools such as Buffer (https://buffer.com/), Hootsuite (https://www.hootsuite.com/), and Sprout Social (https://sproutsocial.com/) provide integrated support for post scheduling, engagement management, analytics, and emerging AI-assisted features (e.g., caption or response suggestions), these capabilities remain largely assistive rather than autonomous. In particular, they offer limited support for advanced semantic reasoning, context-aware intelligent response generation, or end-to-end workflow automation across campaign lifecycles [2]. Consistent with the fact that today's cross-platform workflows are still fragmented, customers may need to surf through various social media platforms to reach the right brand account, which would be an inconvenient process. Consequently, platforms built around chatbots/virtual assistants and improved NLP - Natural Language Processing pushing beyond assistive features toward more seamless, scalable, and increasingly autonomous service interactions would be of much interests [3]. Published literature also flags practical constraints that affect how far multi-platform orchestration can be pushed, including limits on customization across platform types and restricted or rapidly changing API access, which can hinder extensibility and reliable integration. In addition, privacy and regulatory compliance are emphasized as essential considerations when using social data at scale, effectively constraining what automation can collect, store, and act upon [4].

A shift toward AI-enabled marketing communication is

explicitly anticipated, noting that consumers increasingly encounter AI-generated marketing messages and even report comfort with personalized marketing messages generated by marketing automation tools by, for example, Dwivedi et al. [5]. They also frame AI/analytics as mechanisms to optimize the customer journey and highlights the role of AI chatbots in shaping customer experience while stressing that consumer reactions depend on transparency (e.g., disclosure of an AI identity). These points align with the idea that newer generative AI systems can extend personalization and interaction quality by making information production and communication processes more adaptive and responsive to user context. Next, Dwivedi et al.'s [6] opinion paper usefully consolidates various expert perspectives to frame ChatGPT as a productivity-boosting general-purpose text technology with wide implications across sectors, while clearly surfacing recurring risks (misinformation, bias, privacy/security) that complicate real-world adoption. Its main strength is the structured synthesis into a forward-looking research agenda spanning ethics/transparency, digital transformation, and education/scholarly practice, offering concrete directions of both research and practical importance [6]. Currently, in most existing applications, LLMs such as ChatGPT, Google Gemini etc. are employed as isolated components rather than being embedded within an integrated, workflow-driven content management framework. Comprehensive approaches that unify multi-platform management, AI-driven contextual response generation, and workflow orchestration within a single, configurable system that can be tailored to organizational requirements would be the continuing development. Such integration is essential for improving operational coordination, maintaining brand consistency across channels, and enhancing the reliability and quality of user interactions.

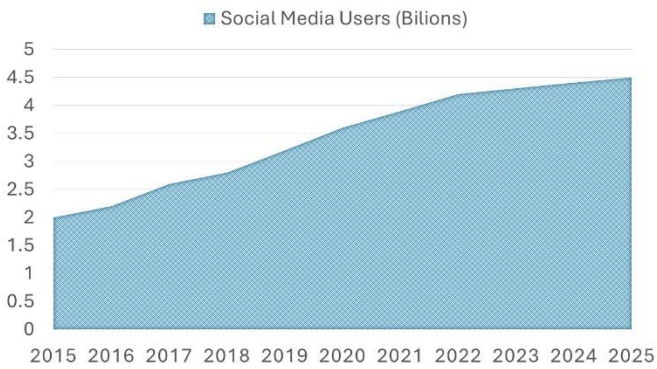

Figure 1. Global social media usage trends: number of users worldwide (in billions), 2015–2025 [1]

Building on this context, the present study proposes the design and implementation of a custom automated multi-platform content management and publishing system integrated with ChatGPT through API calls. The proposed system is characterized by the following features:

- An integrated architecture combining a .NET-based backend, centralized database management, and n8n-based workflow orchestration;
- Multi-account management with synchronized cross-platform scheduling;
- AI-driven comment analysis and context-aware automated responses;
- Configurable AI bots tailored to specific content objectives and audience characteristics.

The main contribution of this study lies in proposing a unified system architecture for multi-platform content management that integrates workflow automation with LLM-based contextual interaction handling, providing a practical foundation for scalable and coordinated digital content operations. To ground this integration in a coherent conceptual model, the study further introduces the CLAW framework as the architectural rationale for coordinating content resources, contextual information, automation logic, and workflow control within a single operational structure. In CLAW, multi-platform content objects and their associated context are treated as first-class system resources, while the LLM component supports contextual interaction handling and the automation/workflow layer (e.g., n8n) governs sequencing, execution, and monitoring of operational tasks such as publishing, data collection, and response routing. The framework also incorporates configurable policies and parameters to enforce governance and operational constraints, as well as a feedback loop that captures logs and outcomes to support iterative refinement of workflows and configurations.

2. LITERATURE REVIEW

2.1 Content management strategies

Commercial content management platforms such as Buffer, Hootsuite, and Sprout Social are widely adopted for multi-platform post scheduling and performance monitoring. These tools primarily focus on operational tasks, including content publishing, calendar management, and high-level engagement reporting. AI integration into these tools regarding the content management process, intelligent interaction handling, deep semantic understanding, or end-to-end workflow automation has been enabled to some extent.

However, commercial platforms often lack flexibility when enterprises manage multiple campaigns, accounts, or platforms concurrently. Limitations related to customization, advanced API integration, scalability, and security and so on are encountered in scenarios involving complex organizational workflows. Consequently, there remains interests for integrated content management systems that are configurable to enterprise-specific processes, support AI capabilities (native or via commercial LLM integration), and are engineered for high scalability and security.

To some extent, much of the existing literature and many commercial systems still approach multi-platform content management as a collection of platform-specific operations such as publishing, scheduling, asset handling, and reporting implemented through separate tools and manual interventions. This fragmentation would increase operational cost and make it difficult to enforce consistent governance, naming conventions, approval rules, and content variants across channels. Workflow support, where present, is often limited to linear pipelines or tightly coupled integrations that are hard to customize, audit, and extend as requirements evolve. Consequently, organizations frequently rely on ad hoc procedures to coordinate roles, approvals, and multi-channel publishing campaigns, which reduces repeatability and complicates maintenance. These limitations underscore the need for a workflow-driven, modular approach that unifies cross-platform operations under configurable orchestration and lifecycle management, enabling consistent execution,

monitoring, and adaptation of content processes without being locked to a single platform or rigid toolchain.

These challenges are especially pronounced for small and medium-sized enterprises (SMEs), where limited financial resources, constrained human capacity, and restricted access to advanced technologies increase dependence on automation while simultaneously exposing the limitations of existing tools. For such organizations, fragmented workflows and manual coordination across platforms can significantly reduce operational efficiency.

A core thread relevant to a workflow-driven content management system is the emerging intersection between Business Process Management (BPM), decision support, and LLMs. Bernardi et al. [7] frame this convergence through AI-augmented, process-aware decision support systems that combine flexibility, autonomy, and conversational interfaces. Kourani et al. [8] empirically investigate the ability of LLMs to produce business process models, proposing a benchmark-driven evaluation framework across diverse processes and multiple state-of-the-art models. Their findings which particularly are the performance variation across models and the association between error handling and output quality reinforce a practical implication for workflow-driven systems: LLM functionality must be engineered with robust guardrails, validation, and error recovery mechanisms when deployed as part of operational tooling. The above highlighted BPM-oriented literature motivates an architectural view where LLMs participate in workflow execution, decision support, and conversational interaction, while being bounded by process logic and systematic evaluation.

As a solution to the problem of making plain LLM outputs reliable and practical in organizational settings, Klesel and Wittmann [9] position RAG - Retrieval-Augmented Generation as a response to enterprise information access problems and the hallucination risk arising when models lack access to proprietary or situational knowledge. Their framing is important for multi-platform content management because content operations typically require up-to-date internal policies, campaign briefs, brand guidelines, product specifications, and platform-specific constraints, specific knowledge that is often absent from model pretraining. RAG provides a system-level mechanism to ground outputs in retrievable organizational data and to reduce hallucination risk by correlating generation to existing evidence. Recently, there appear more and more reported research on application of RAG to various practical domains. As an example, Wu et al. [10] extend RAG principles in a domain-intensive context which is construction management domain where document scale, ambiguity, and granularity mismatch degrade retrieval quality. Their RAG4CM paradigm introduces hierarchical document parsing and structured knowledge pools, coupled with tailored search algorithms to improve granularity alignment. Notably, they also incorporate user preference learning, enabling iterative improvement from interaction feedback. The RAG literature would suggest additional functions of a custom-built multi-platform content management system including (1) a retrieval layer that integrates cross-platform and organizational context, (2) segmentation/indexing strategies that reflect task and workflow semantics (not merely file boundaries), and (3) feedback mechanisms that incrementally tune outputs toward organizational preferences.

Regarding generative AI's role in marketing and content creation, which is central to multi-platform content management, Grewal et al. [11] describe generative AI as a force reshaping marketing through new modes of customer interaction, content creation (text, image, video), and product/service development. Their four-quadrant organizing framework which is built around the nature of inputs and the degree of human augmentation highlights a key operational tension: automation can increase speed and scale, but the optimal configuration depends on task risk, required customization, and the acceptable level of human error. Islam et al. [12] similarly propose a structured conceptual approach named MARK-GEN for integrating generative models into marketing content creation, supported by case studies. This reinforces the notion that value is unlocked not merely by having a model available, but by embedding it within an end-to-end method that includes content objectives, channel selection, and repeatable production cycles. Katsamakas and Sanchez-Cartas [13] further discuss platform economics, arguing that GenAI (Generative AI) content platforms can alter incentives, pricing, and the number of human creators, with heterogeneous effects depending on competition and entry costs. For multi-platform content management, this underscores that GenAI adoption is not purely a technical decision: it influences creator roles, organizational staffing models, and possibly platform-level policies. As content ecosystems evolve, systems that integrate LLMs and automation must remain adaptable to platform governance, disclosure norms, and changing engagement dynamics. The research results would justify workflow-centric architectures where AI can either assist humans or automate parts of their work, depending on requirements, without sacrificing control or accuracy.

While generative AI can scale content production, in the literature, there appear more and more warns of trust and authenticity risks. They directly affect how multi-platform systems should be designed. Brüns and Meißner [14] provide empirical evidence that GenAI use in social media content creation can diminish perceived brand authenticity and trigger negative follower reactions, especially when GenAI involvement is disclosed. Importantly, they find attenuation when GenAI assists humans rather than replacing them. Hermann and Puntoni [15] extend the governance discussion through an ethics-informed framework and their ASSURANCE principles (Autonomy, Security, Sustainability, Representativeness, Accountability, Nonbiasedness / nondiscrimination, Crediting, Empowerment). These studies imply that a multi-platform content management system should treat ethical and authenticity controls as workflow primitives embedded in orchestration and publishing logic rather than as external policy documents.

Beyond marketing, applied conversational systems illustrate the practical possibility for embedding LLMs into service workflows. Vega-Huerta et al. [16] report a ChatGPT-based conversational AI for a university admissions context, motivated by dissatisfaction with traditional service channels and a need for scalable, accessible support. Their results emphasize measurable service outcomes (reduced wait times, high satisfaction) and reinforce a broader pattern: LLMs are most valuable when deployed as components of a service delivery pipeline with defined intents, escalation paths, and continuous improvement. Although admissions support differs from content management, the structural parallel is strong: both involve repeated high-volume interactions, a need for consistent policy-aligned responses, and the requirement to

integrate with operational systems (knowledge bases, schedules, platform channels). This supports the system-oriented approach of integrating LLM response generation with automation and workflow layers.

In addition, Deshmukh et al. [17] argue that NLP systems reach higher utility when they combine machine scalability with human creativity and domain expertise. Their emphasis on human-guided organization, annotation, and error correction aligns with the authenticity and ethics literature, but also with practical content operations: brand voice, cultural nuance, and campaign intent are often difficult to fully specify in rules. A workflow-driven system can encode collaboration patterns including draft, critique, revise, approve and capture feedback signals that continuously calibrate the LLM's role. From a CLAW perspective, this research supports treating collaboration as a system capability: workflows should not merely trigger automation but should coordinate humans, content assets, and AI outputs into repeatable operational cycles.

2.2 Research gap

Based on the preceding literature investigation, several key research gaps can be identified as shown below.

First, most existing commercial content management tools remain primarily limited to scheduling and basic reporting functionalities, AI-driven response mechanisms and advanced semantic analysis capabilities are available to some extent. Thus, using these tools, customized support for adaptive interaction handling in dynamic, multi-platform environments need further discussions.

Second, some studies have examined the integration of LLMs with workflow automation in a manner that enables a complete end-to-end feedback cycle, encompassing content publishing, interaction analysis, automated response generation, and subsequent content optimization. Existing research typically addresses individual stages of this process rather than supporting continuous, closed-loop content management.

Third, issues related to API security and AI bias control remain insufficiently addressed in the literature, particularly in the context of small and medium-sized enterprises (SMEs). This limitation is critical for automated systems that operate across multiple platforms and interact with diverse user groups under strict platform security policies.

In addition, prior research has not yet proposed a unified architectural approach that systematically links cross-channel contextual reasoning with multi-step workflow orchestration. As a consequence, existing solutions remain fragmented and, to some extent, are unable to sustain continuous improvement cycles based on operational feedback and interaction outcomes.

More broadly, current studies tend to focus either on operational automation or on AI-enhanced content interaction in isolation, while rarely examining how these two dimensions can be combined to support scalable, secure, and adaptive multi-platform content management.

The present study on the development of a workflow-driven multi-platform content management system integrating the .NET framework, n8n automation, and GPT-based contextual response generation within a unified CLAW architecture can be positioned as a system-level integration response to fragmentation in practice. The CLAW architecture directly targets this integration gap by making content, LLM grounding, automation and workflow governance co-equal architectural layers.

2.3 The CLAW conceptual framework (CLAW: Content-LLM-Automation-Workflow)

In many real-world content management scenarios, LLMs are integrated into existing systems in an ad hoc manner, typically as add-on services for content generation or automated replies. Such integrations tend to focus on isolated functionalities and do not fully address the coordination of cross-platform context, workflow-aware orchestration, and continuous system adaptation. As a result, content management processes often remain fragmented and heavily dependent on manual configuration when operating across multiple platforms.

To address this limitation, Figure 2 introduces the CLAW framework as a cohesive conceptual foundation for AI-driven and workflow-integrated digital content management. The CLAW framework aims to enable systematic coordination between content resources, contextual information, automation logic, and LLM-based reasoning within a unified operational structure.

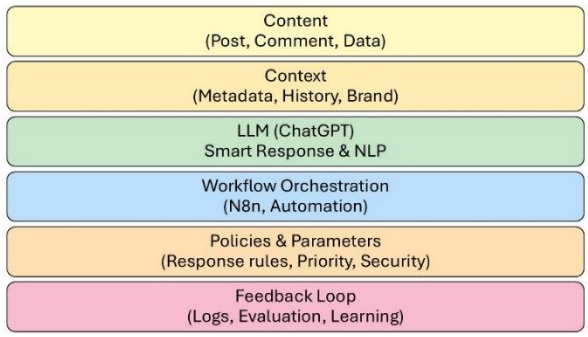

Figure 2. The CLAW conceptual framework
Note: Content–LLM–Automation–Workflow.

Core components of the CLAW framework include:

- Content: Multi-platform data objects such as posts, comments, messages, and interaction records that require coordinated management across different social media environments.
- Context: Metadata associated with content and interactions, including interaction history, platform characteristics, audience attributes, and brand-related constraints that influence system behavior.
- LLM (e.g., ChatGPT): The generative and reasoning component responsible for producing context-aware responses and supporting adaptive interaction handling.
- Workflow orchestration (e.g., n8n): The component that sequences, coordinates, and controls system actions, including content publishing, data collection, analysis, and automated response generation.
- Policies and parameters: Configurable rules and operational settings that govern system behavior, such as response scenarios, prioritization strategies, access control, and security mechanisms.
- Feedback loop: A continuous monitoring mechanism that captures operational logs and interaction outcomes, enabling iterative refinement of workflows, configurations, and response strategies.

2.3.1 Design principles of the CLAW framework

The CLAW framework is guided by three core design principles:

- Cross-channel context integration: Aggregating and harmonizing data across multiple platforms to support coherent and consistent interaction handling.
- State-aware orchestration: Selecting and sequencing system actions based on workflow states, system conditions, and predefined operational objectives.
- Feedback-driven adaptation: Using operational data and interaction outcomes to support continuous improvement of workflows and response configurations over time.

2.3.2 Conceptual contribution of CLAW

Rather than serving as a benchmark-oriented evaluation model, the CLAW framework functions as a conceptual and architectural foundation for designing workflow-driven, AI-enabled content management systems. It provides a structured way to reason about the interaction between content, context, automation, and LLM-based intelligence, while remaining flexible enough to support different organizational requirements and platform configurations.

By unifying these elements within a single framework, CLAW offers an integrated alternative to fragmented CMS–LLM implementations. The framework supports both practical system design and conceptual analysis, making it applicable to real-world deployments as well as future research on AI-assisted content management and workflow automation.

2.4 Applications of AI and LLMs in content management

Artificial intelligence (AI) has been increasingly applied in digital marketing and content management research. Literature review indicates that AI-based techniques play an important role in supporting content personalization, optimization, and audience targeting, thereby enhancing the effectiveness of digital communication strategies. From this perspective, AI is often viewed as a foundational technology for improving how organizations design and manage content-driven interactions.

Recent research has further highlighted the role of LLMs in content management. LLMs are commonly applied to support content generation and conversational interaction, enabling systems to produce more context-aware and linguistically coherent responses [18]. Such capabilities are particularly relevant in interactive digital environments, where timely and contextually appropriate responses contribute to improved user experience.

Beyond content creation, several studies discuss the potential of AI to influence content management workflows more broadly. AI-driven approaches have been explored for tasks such as content classification, interaction filtering, recommendation support, and automated response handling [19]. These applications suggest that AI can assist in coordinating communication activities across channels, rather than functioning solely as a standalone content generation tool.

Despite these advancements, the literature reveals several limitations in existing AI-supported approaches. First, to the authors' best knowledge, applications presently operate primarily at the content or interaction level, without addressing the coordination of end-to-end workflow processes. Second, LLMs are frequently deployed as isolated services and are not tightly integrated into multi-step orchestration pipelines that manage publishing, monitoring, and response actions. Third, contextual reasoning is often constrained to single-channel or session-level interactions, with limited consideration of aggregated cross-platform context [20].

These constraints limit the ability of current AI-driven solutions to achieve unified and coherent content management across multiple platforms. Consequently, integrated frameworks that explicitly combine LLM-based reasoning with workflow orchestration and cross-channel context management are of much interest. Frameworks such as CLAW aim to address this need by bridging the gap between AI-assisted content generation and the operational requirements of multi-platform content management workflows.

2.5 Workflow automation and API security

Workflow automation has become an important approach for reducing repetitive tasks and improving operational efficiency in complex digital systems. Prior research suggests that automation techniques can support the coordination of multiple services and processes, particularly in environments where systems must orchestrate numerous API-based interactions simultaneously [21]. This perspective is especially relevant for multi-platform enterprises, where large volumes of data and user interactions require structured and reliable automation mechanisms.

Recent studies on automation engines such as n8n, Apache Airflow, and Node-RED emphasize their ability to coordinate multi-step tasks, trigger condition-based actions, and integrate heterogeneous services through APIs. These capabilities are commonly discussed as key enablers for managing distributed workflows and handling dependencies across system components, making workflow automation increasingly important for scalable content management operations.

Alongside these opportunities, the literature also highlights challenges related to security and bias in automated and AI-enabled systems. Research on NLP and LLMs indicates that bias in language processing can negatively affect response quality and fairness in AI-assisted communication [22]. Such issues are particularly relevant for automated response systems that operate across diverse user groups and social media platforms.

In addition, workflow-centric architectures are frequently associated with heightened security requirements. Studies emphasize the need for robust authentication mechanisms, rate limiting, monitoring, and logging to prevent API misuse and unintended system behavior. These considerations become more critical when automated workflows interact with multiple external platforms that enforce strict security and access control policies.

Despite these insights, existing literature reporting workflow automation, API security, and LLM-driven content management within a unified architectural perspective is rare. Automation research often concentrates on technical task coordination, while security and bias studies focus on linguistic or ethical concerns in isolation. Investigation is required to understand how automation orchestration, secure API interaction, and context-aware language processing can be jointly addressed within a single multi-platform content management system. It further motivates the need for integrated frameworks such as CLAW, which consider workflow automation, API security, and LLM-based contextual reasoning as interdependent components of AI-enabled content management architectures.

3. RESEARCH METHODOLOGY

This chapter outlines the methodology used to design and implement an automated multi-platform content management system based on the CLAW architecture. The system focuses on AI-assisted content creation and coordinated content publishing across multiple social media platforms.

The proposed architecture integrates a .NET-based backend, an MS SQL database for centralized management, the n8n workflow orchestration engine, and the ChatGPT language model for automated content generation. Workflow automation is used to coordinate content creation, scheduling, and platform-specific publishing through secure API integration.

The following sections describe the system architecture and workflow design in detail, providing a system-oriented perspective on scalable and efficient multi-platform content management.

3.1 Research design

This study adopts a system-oriented design approach commonly used in information systems and software engineering research. Rather than focusing on experimental evaluation, the research emphasizes the design, implementation, and practical feasibility of an automated multi-platform content management system.

The research process consists of three main stages. First, existing content management tools and workflows are examined to identify functional limitations and operational requirements. Second, a system architecture is designed based on the CLAW framework, incorporating backend services, database management, workflow orchestration, AI-based content generation, and secure API integration. Third, a functional prototype is developed to demonstrate how the proposed architecture supports coordinated content creation and publishing across multiple platforms.

This approach ensures that the study is grounded in real-world content management practices while maintaining a clear focus on system design and operational integration.

3.2 System architecture

To support multi-platform content publishing and AI-assisted content creation, this study proposes a multi-layered system architecture based on the CLAW framework. The architecture integrates a large language model for content generation, a workflow orchestration engine for process coordination, and a secure backend infrastructure for managing data and external platform connections. Figure 3 illustrates the overall system architecture.

The core components of the system include:

-User interface layer: A web-based administration interface used to configure platforms, manage content schedules, and monitor publishing status.

-.NET backend services: Responsible for business logic, request validation, content preparation, and coordination with external services.

-MS SQL database: Stores content drafts, publishing schedules, configuration data, and system logs.

-Workflow orchestration engine (n8n): Coordinates the end-to-end publishing workflow, including content generation, scheduling, and platform-specific posting.

-Social media APIs: Enable integration with multiple platforms such as Facebook, Telegram, Threads, and Zalo.

-ChatGPT (LLM): Generates AI-assisted content based on predefined prompts, platform characteristics, and content configuration.

As shown in Figure 3, administrators interact with the system through the user interface, while backend services and workflows handle content generation and publishing in a coordinated manner. The layered design reduces tight coupling between components and facilitates extensibility, allowing additional platforms or AI configurations to be integrated with minimal architectural changes.

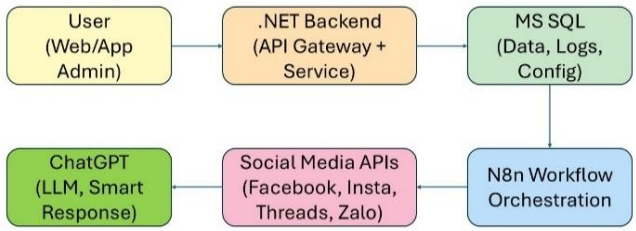

Figure 3. Overall system architecture

3.3 Functional modules

The proposed system is organized into four core functional modules.

- Multi-platform content publishing: Supports synchronized posting across multiple social media platforms using centralized scheduling and platform-specific publishing configurations.
- AI-assisted content generation: Utilizes ChatGPT to generate or refine content drafts based on predefined prompts, campaign objectives, and platform constraints.
- Workflow automation: Employs workflow orchestration to manage content creation, scheduling, and publishing processes in a structured and repeatable manner, reducing manual cross-platform operations.
- Multi-account management: Provides centralized management of multiple social media accounts and publishing configurations, supporting the operational needs of small and medium-sized enterprises (SMEs).

Together, these modules support the complete content lifecycle, from content creation to coordinated multi-platform distribution, while maintaining consistency and operational efficiency.

3.4 Research procedure

The research procedure includes the following stages:

-Requirement gathering: Collecting practical requirements from businesses and individual content creators to identify needs related to content creation, scheduling, and multi-platform publishing.

-System architecture design: Designing the system architecture based on the requirements analysis, including backend services, database management, workflow orchestration, AI-assisted content generation, and secure API integration.

-Prototype implementation: Developing a functional prototype by integrating the backend system, centralized database, workflow orchestration engine, and real-world social media APIs to support automated content

generation and scheduled publishing.

These stages emphasize system design and practical implementation, demonstrating how AI-assisted content creation and workflow automation can be combined to enable coordinated multi-platform content management.

3.5 System specifications

To support transparency and repeatability, the core specifications of the proposed system are documented as follows:

- -Source code structure: The system is implemented using a multi-layer architecture, including a .NET-based backend, an MS SQL database, and n8n workflows. Core modules related to content management, AI-assisted content generation, and publishing automation are decoupled to facilitate replication and extension.
- -API specifications: Integrations with social media platforms (Facebook, Instagram, Telegram, Zalo) and the ChatGPT API are documented, including endpoint structures, request parameters, authentication methods, and invocation constraints relevant to content publishing.
- -Content configuration and prompts: Standardized JSON-based configuration files are used to define content templates, prompt structures, and platform-specific constraints for AI-assisted content generation, enabling consistent behavior across publishing workflows.
- -LLM configuration parameters: Fixed configuration settings for content generation (e.g., temperature, token limits, and response constraints) are specified to ensure consistent AI-generated outputs across system executions.
- -Workflow definitions: n8n workflow configurations describe the publishing logic, scheduling triggers, platform-specific routing, and logging mechanisms that govern automated content distribution.

The main specifications of the system are summarized in Table 1.

Table 1. Summary of the main specifications of the system

Component	Description	Format
Source code structure	.NET modules, MS SQL, n8n workflows	Technical documentation
APIs and parameters	Social media and LLM integration details	JSON / YAML
Content configuration	Prompts and publishing templates	JSON
LLM configuration	Content generation parameters	Configuration table
Workflow definitions	Automated publishing workflows	n8n workflow files

4. RESULTS

4.1 System prototype

Figure 4 presents the implemented system prototype, which has been deployed with a centralized administration interface for multi-platform content management. The prototype provides users with a unified environment to configure accounts, prepare content, and manage publishing schedules across multiple social media platforms.

Through the administration dashboard, users can register and manage multiple social media accounts, define publishing schedules with platform-specific configurations, and monitor publishing status. In addition, the system supports AI-assisted content creation, allowing users to generate or refine post content using predefined prompts and configuration parameters.

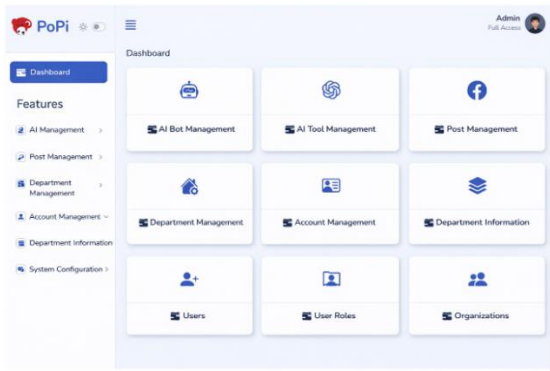

Figure 4. Screenshot of the prototype interface

The prototype demonstrates how content creation and multi-platform publishing can be coordinated within a single system, addressing common limitations of existing commercial tools that often require separate workflows for different platforms.

4.2 Verified core functions

The prototype was used to verify the operation of the system's core functional modules in practical publishing scenarios. The following key functions were successfully demonstrated:

- Multi-platform content publishing: The system supports synchronized content distribution across multiple social media platforms based on centralized scheduling and platform-specific publishing rules.
- AI-assisted content generation: The integrated language model enables users to generate content drafts that can be adapted to different platforms and campaign objectives, reducing manual content preparation efforts.
- Workflow automation: Publishing workflows are coordinated through the n8n orchestration engine, ensuring that content stored in the database is retrieved and published at the designated time without manual intervention.
- Multi-account management: The system allows multiple social media accounts to be managed concurrently within a single interface, supporting practical use cases for small and medium-sized enterprises.

These functions confirm that the system operates as intended and supports the complete content lifecycle from content preparation to coordinated distribution.

4.3 Design comparison and architectural analysis

To clarify the design contribution of the proposed system, this section provides a qualitative comparison between the CLAW-based architecture and commonly adopted alternatives in multi-platform content management. Rather than relying on quantitative benchmarks or component-level ablation experiments, the comparison focuses on architectural

characteristics and operational scope.

Traditional manual workflows rely heavily on human operators to create, schedule, and publish content separately on each platform. While flexible, such approaches scale poorly and require significant coordination effort, making them unsuitable for sustained multi-platform content operations.

Commercial content management tools primarily improve efficiency by introducing centralized scheduling and basic automation. However, these tools typically treat content creation, scheduling, and publishing as loosely connected functions. AI capabilities, when present, are often limited to basic analytics or template-based assistance and are not integrated into a unified workflow.

Systems that incorporate large language models without workflow orchestration provide enhanced content generation capabilities but lack structured process coordination. In such designs, AI-assisted content creation remains detached from scheduling logic, platform-specific constraints, and operational control, leading to fragmented workflows and increased management overhead.

In contrast, the proposed CLAW-based system is designed as an integrated architecture in which AI-assisted content generation and workflow orchestration are treated as interdependent components. Content creation, scheduling, and publishing are coordinated through explicit workflows, allowing platform-specific constraints and configuration parameters to be consistently enforced. The architectural emphasis is placed on modularity and extensibility rather than isolated performance gains.

From an architectural perspective, the key distinction of the proposed system lies in its ability to combine AI-assisted content creation with workflow-driven publishing automation within a single operational framework. This integration supports scalable multi-platform management while maintaining centralized control and reducing manual cross-platform coordination.

5. DISCUSSION

5.1 Significance of the system design

The proposed system demonstrates the feasibility of integrating AI-assisted content generation with workflow-based multi-platform publishing within a unified architectural framework. Rather than treating content creation and publishing as separate processes, the system coordinates these activities through explicit workflows, reducing fragmentation and manual intervention in content operations.

From a system perspective, the significance of the proposed design lies in its ability to support consistent content management across multiple platforms while maintaining centralized control over content configuration, scheduling, and distribution. This design addresses practical challenges commonly encountered in real-world content operations, particularly for organizations that manage multiple social media accounts concurrently.

5.2 Theoretical and practical contributions

From a theoretical standpoint, this study contributes a system-oriented architectural perspective to research on AI-driven content management. While prior work has primarily examined LLMs in the context of text generation, the present study extends this line of research by embedding LLM-based content generation within a workflow orchestration framework. This integration highlights the role of workflows as a structural mechanism that connects AI capabilities with operational content management processes.

From a practical perspective, the proposed system provides an integrated solution for AI-assisted content creation and coordinated multi-platform publishing. The architecture supports configurable content generation, centralized scheduling, and automated distribution, making it suitable for small and medium-sized enterprises, media organizations, and independent content creators that require scalable content management solutions without deploying complex enterprise systems.

Figure 5 summarizes the main contributions of the study, emphasizing the integration of AI-assisted content generation, workflow automation, and multi-platform content management within a single architectural framework.

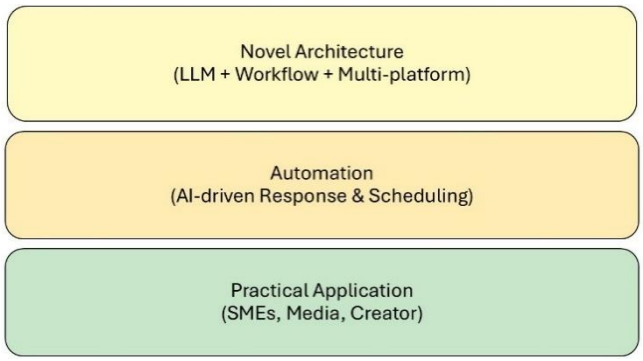

Figure 5. Summary of contributions

5.3 Limitations

Despite its practical applicability, the proposed system has several limitations. First, the system depends on external social media platform APIs, and changes in platform policies or interfaces may affect system functionality and require maintenance updates. Second, the quality of AI-assisted content generation remains sensitive to the design of prompts and configuration parameters, which necessitates careful system setup and ongoing refinement. Third, while basic security mechanisms are implemented, more advanced analyses such as comprehensive threat modeling and formal security certification are beyond the scope of the current system.

These limitations reflect the current scope of the study, which focuses on architectural design and system integration rather than exhaustive operational optimization.

5.4 Future directions

Based on the preceding analysis, future development of the system may include the following directions:

- Enhancing AI-assisted content generation by improving prompt design, campaign-level content configuration, and platform-specific adaptation of generated content.
- Integrating content effectiveness forecasting modules to support content planning and adjustment prior to publication, enabling more informed scheduling and publishing decisions.
- Linking the system with external enterprise platforms,

such as customer relationship management (CRM) or analytics systems, to synchronize content planning and support broader digital marketing workflows.
- Expanding multilingual content generation capabilities to support cross-border operations and multi-regional publishing requirements.
- Strengthening security governance through advanced analyses, including threat modeling, robustness against prompt injection, and alignment with international standards such as ISO/IEC 27001.

Figure 6 presents a conceptual roadmap for future system development, illustrating how the current prototype can evolve toward more advanced, secure, and enterprise-oriented content management capabilities.

As shown in Figure 6, a four-stage roadmap is planned for future development of the system based on the present system developed in this study:

i. optimize the current Prototype System (multi-platform + ChatGPT),
ii. advancing Sentiment Analysis with multi-dimensional modeling,
iii. implementing Engagement Prediction to optimize content prior to publishing,
iv. expanding to Enterprise Integration with CRM, analytics, and multilingual support.

This roadmap highlights that the study not only delivers experimental results but also outlines a clear long-term development trajectory aligned with global business application needs.

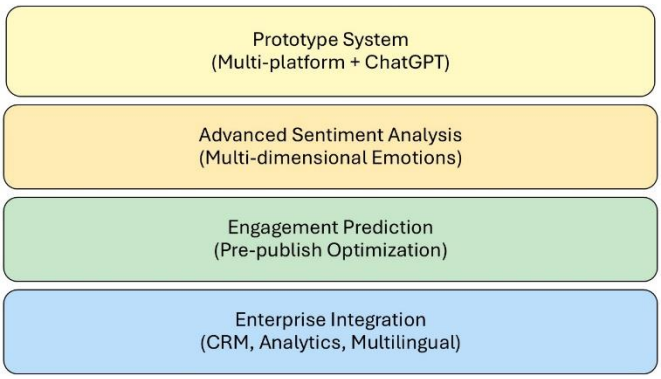

Figure 6. Roadmap for future development connected with present system

6. CONCLUSIONS

This study presents the design and implementation of an automated multi-platform content management system powered by a large language model and workflow orchestration. The proposed system is built on an integrated architecture combining a .NET-based backend, an MS SQL database, the n8n workflow engine, and secure API communication mechanisms. The system focuses on AI-assisted content creation and coordinated content publishing across multiple social media platforms.

From a research perspective, the study contributes a system-oriented architectural approach that integrates large language models with workflow automation for multi-platform content management. By embedding AI-assisted content generation within structured publishing workflows, the proposed architecture extends existing approaches that primarily treat AI as an isolated content creation tool.

From a practical perspective, the system provides a unified solution for managing content creation, scheduling, and publishing across multiple platforms. The architecture supports centralized configuration, automated workflows, and extensibility, making it suitable for small and medium-sized enterprises, media organizations, and individual content creators seeking scalable content management solutions.

Overall, this research demonstrates the feasibility of combining AI-assisted content generation with workflow-driven publishing automation within a single architectural framework. The proposed system provides a foundation for future development and research in AI-enabled, multi-platform content management systems, emphasizing architectural integration, operational coherence, and practical applicability.

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