A Domain-Specific Prompting Enhancement System for Project Managers: Semantic Augmentation, Recommendation and Hybrid Feedback

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1. Introduction

Generative AI (Gen-AI) tools have demonstrated significant potential in enhancing project management during the full life-span within the built environment industry [1], [2], [3]. However, unsatisfactory user interactions and responses limit their widespread adoption [4], [5]. A critical challenge lies in the lack of domain-specific prompt engineering tailored to project managers (PMs), whose unique occupational knowledge and organizational readiness levels influence their AI interactions [6]. This research aims to address these challenges by developing a prompting system based on the theoretical innovations about domain-specific features of PMs. In detail, this study will fulfill the following 4 objectives.

1) To identify domain-specific features of PMs from existing literature and erect mapping between these features and prompt preferences.

2) To optimize semantic augmentation strategies by leveraging the domain-specific features of PMs. (System function 1).

3) To realize the prompt recommendation by utilizing the mechanisms between PMs' domain-specific features and the prompt preferences in the collaborative filtering of Gen-AI tools. (System function 2).

4) To design the hybrid feedback function that improves the performance of candidate prompts and enhances users' prompting skills by multiple rounds of iterations. (System Function 3).

2. Methodology

By identifying PM-specific features and embedding them into a structured system, the research optimizes Gen-AI interactions through semantic augmentation, personalized prompt recommendations, and a hybrid feedback mechanism.

2.1 Identification of Domain-Specific Features

In this study, domain-specific features of PMs are categorized into personal Gen-AI competence [7] and current organizational Gen-AI readiness under the control of specific PMs [8]. Personal competence encompasses Gen-AI knowledge, digital literacy, and critical thinking. Organizational Gen-AI readiness includes factors such as digitalization levels, regulatory compliance, and technological adaptation. By conducting a survey of 150 PMs, the study establishes correlations between these features and prompting preferences, which are categorized into structural, adaptive, and sentimental dimensions. This mapping forms the foundation for understanding PM-specific behaviors and informing the design of effective prompting strategies.

2.2 Development of the Prompt Enhancement System

First, the mapped features are embedded into a system framework that guides semantic augmentation. This includes strategies such as role-specific augmentation [9] and chain-of-thought (CoT) [10] to embed occupational contexts and contextual completion to dynamically fill in missing information. When PMs input rough prompts into the system, their user profiles guide the selection of the most suitable augmentation strategies.

Second, A user-centric recommendation function is then activated to generate and rank the top three prompt options using a scoring system that balances user preferences with augmentation requirements.

Third, the feedback mechanism combines explicit feedback (such as user ratings and trust assessments) [11], with implicit feedback (such as response time, and visual perceptual factors) [12] derived from interaction patterns and user profiles. Two-way effects of this feedback loop will be emphasized to both improve the system performance and AI capabilities of domain-specific users as PMs.

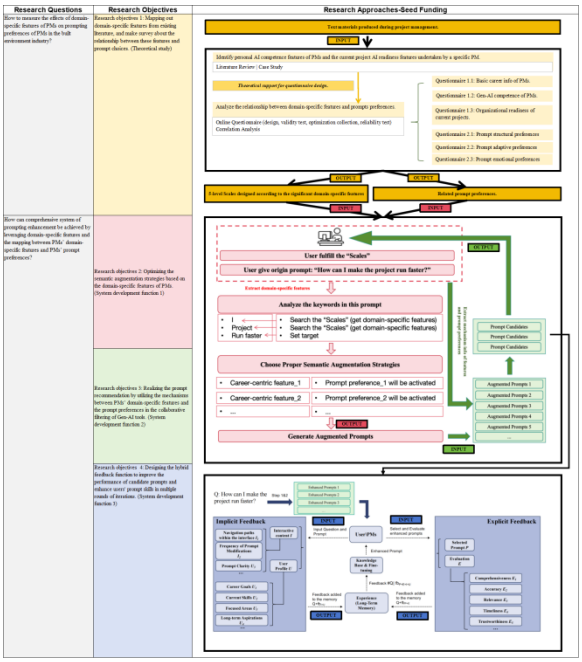

Fig. 1: Research Plan

3. Expected Contributions

This study holds both academic and practical significance within interdisciplinary fields. For academic contributions:

1)To fill a critical research gap by exploring domain-specific features and prompting preferences in the application of Gen-AI within the built environment sector.

2)To establish a theoretical framework that links domain-specific features to Gen-AI prompt strategies, advancing the understanding of AI integration in specialized domains.

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For practical contributions:

1) To enhance decision-making and resource allocation in project management by optimizing the application of Gen-AI tools.

2) To introduce user-friendly and intuitive tools for integrating Gen-AI into professional practices, facilitating seamless adoption.

3) To improve user competencies and fosters trust in AI systems through the implementation of iterative feedback mechanisms.

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