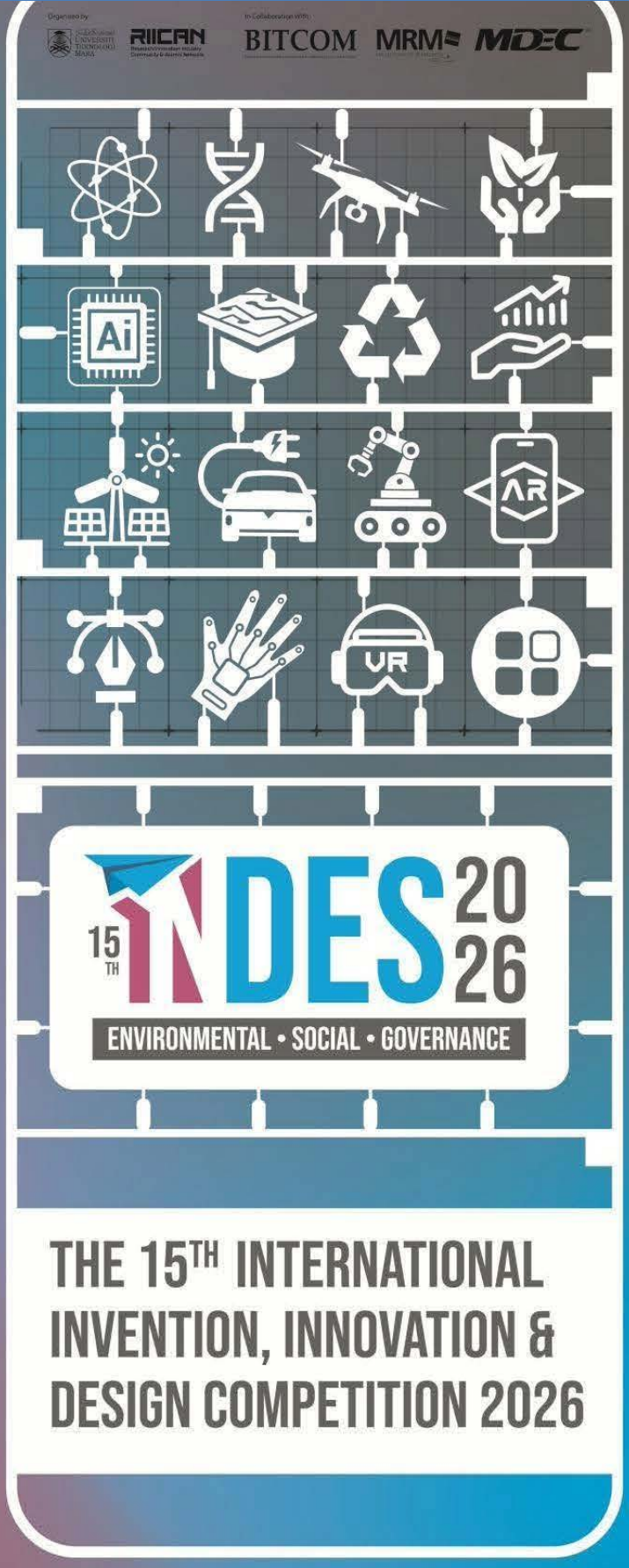


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EXTENDED ABSTRACT

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THE 15th INTERNATIONAL
INVENTION, INNOVATION &
DESIGN COMPETITION 2026

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MAESTRO: ORCHESTRATING MULTI-AGENT AI ARCHITECTURE FOR SCALABLE EVENT MANAGEMENT SYSTEM

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ABSTRACT

Conventional communication tools such as WhatsApp lack the structure needed for event workflows, often resulting in fragmented information, document version conflicts, and coordination breakdowns. This highlights the need for a centralized and intelligent system to support coordinated event planning. This study proposes MAESTRO, a centralized event management system integrating a multi-agent Artificial Intelligence (AI) architecture that enables natural language interaction and task orchestration using an Agile development approach. User requirement validation was conducted through a mixed-method survey with 30 university students and staff. Survey results showed strong agreement across all requirement dimensions with mean scores above 4.00, confirming that the identified coordination and communication challenges are real and widely experienced. A foundational prototype was developed comprising seven interface modules, including an event dashboard, an AI chatbox, document version control, and a networking page. The study demonstrates the feasibility of combining centralized system design with AI-assisted coordination, contributing a scalable, multi-agent framework that enhances collaborative event management in academic environments.

Keywords: multi-agent AI, event management system, LangChain, natural language interface, Agile Scrum

1. INTRODUCTION

Event management in educational institutions has grown increasingly complex, with student committees and organizing teams relying on general-purpose tools such as WhatsApp for coordination. These platforms were designed for personal communication and lack structured support for project workflows, causing fragmented information, version control failures, and difficulty tracking task progress across teams (Draz et al., 2023). Existing event management platforms, such as Cvent and EventMobi, focus primarily on attendee-facing features and do not address the internal collaboration needs of organizing teams.

The emergence of multi-agent AI systems introduces an opportunity to rethink event coordination. Unlike single-function automation, multi-agent architectures distribute responsibilities among specialized components that collaborate to handle complex, multi-step tasks. The adoption of AI-driven systems across enterprise and organizational workflows is accelerating rapidly, with multi-agent architectures gaining particular traction for their ability to decompose complex operations into coordinated sub-tasks (Joshi, 2025). The Maestro system was developed to respond to three core problems: the structural inadequacy of existing communication tools for event management, information synchronization failures that disrupt team coordination, and the limited adoption of AI-assisted coordination in current event platforms. This study contributes a scalable multi-agent architecture specifically designed to support internal event coordination workflows.

2. METHODOLOGY

2.1 Research Approach and Development Methodology

The study adopts a pragmatist research philosophy emphasizing practical problem-solving. A top-down, design-oriented approach was used, beginning with problem identification from existing practices and translating these

into a system design refined through iterative development and evaluation. Agile Scrum was selected as the software development methodology for its structured yet flexible sprint-based cycles, which suit projects involving emerging technologies with evolving requirements (Schwaber & Sutherland, 2020). Development was structured across five phases: Initiation, Planning and Estimating, Implementation, Review and Retrospective, and Release.

2.2 System Architecture and Technology Stack

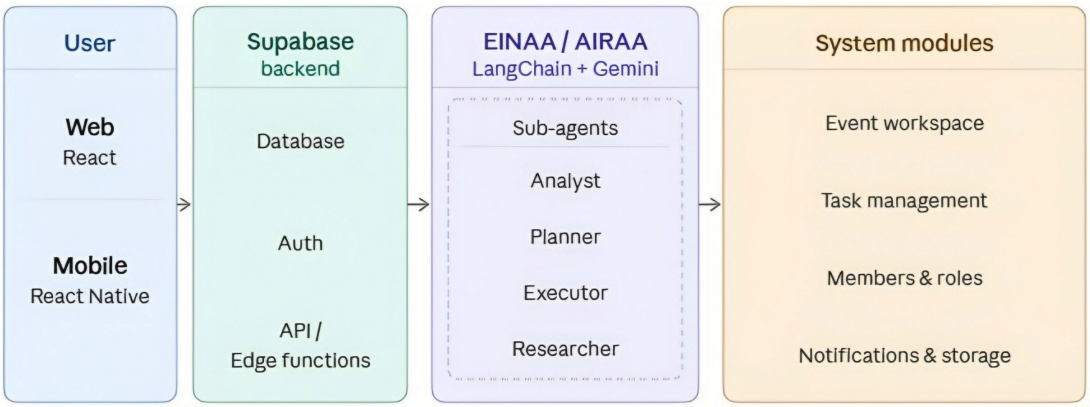


Figure 1 Maestro Architecture Diagram

The Maestro system is built using React 18 for the web frontend deployed on Vercel, React Native with Expo for cross-platform mobile, Supabase as the backend providing PostgreSQL, and LangChain Framework with Google Gemini as the AI orchestration framework alongside several free AI models from OpenRouter Platform. LangChain was selected for its built-in support for agent orchestration, tool integration, and chain-of-thought reasoning pipelines, enabling modular and extensible AI workflow management (Topsakal & Akinci, 2023). Model access is handled through OpenRouter, a unified API gateway that provides access to multiple large language models, allowing flexible model selection and substitution based on availability and performance.

A multi-agent architecture was adopted over a single-agent approach to enable separation of concerns, where specialized agents independently handle distinct task types in parallel, reducing processing bottlenecks, improving system scalability, and reducing hallucinations with the internal AI discussions. The multi-agent architecture follows an orchestrator-worker pattern where a Coordinator Agent interprets user intent expressed in natural language and delegates tasks to specialized sub-agents responsible for reminders, document summarization, and status updates. This stateless design keeps computation costs low while enabling parallel task execution. Figure 1 illustrates the system architecture, depicting the flow from user input through the Coordinator Agent, which is Google Gemini named Einaa and Airaa, to the respective sub-agents and the system modules.

2.3 Data Collection and Analysis

User requirement validation was conducted through an online survey distributed within the university community using convenience sampling. The instrument comprised a five-point Likert scale across five requirement dimensions and one open-ended question for qualitative feedback. Quantitative data were analyzed using descriptive statistics, while qualitative responses were examined through thematic analysis.

3. FINDINGS

Survey results from 30 respondents confirmed strong agreement across all requirement dimensions (Table 1). Communication effectiveness recorded the highest mean score (M = 4.40, SD = 0.72), consistent with the identified problem of miscommunication as a primary disruption to event execution. All five dimensions scored above 4.00, with low standard deviations indicating consistent responses across participants. A threshold of 4.00 on a five-point Likert scale denotes strong agreement, indicating that respondents actively recognized these as real and pressing operational challenges rather than marginal concerns. The elevated score for communication effectiveness in particular suggests that communication breakdown is the most critical issue experienced by event organizers, reinforcing the need for an AI-assisted coordination mechanism. 90% of respondents reported prior event management experience, strengthening the reliability of the findings.

Table 1 Summary of Requirement Validation Results (n = 30)

Requirement Dimension	Mean	Std. Dev.	Interpretation
Information Management	4.03	0.93	Strong agreement
Task Coordination	4.13	0.82	Strong agreement
Progress Transparency	4.07	0.91	Strong agreement
Communication Effectiveness	4.40	0.72	Very strong agreement
Digital Collaboration	4.17	0.85	Strong agreement

The study observed that the prototype successfully demonstrated core coordination workflows across seven interface modules. Users were able to navigate between the home dashboard and event dashboard without confusion, suggesting that the card-based layout and milestone organization were intuitive. The Maestro AI chatbox was observed to respond accurately to natural language queries related to venue status and follow-up reminders, validating the orchestrator agent's ability to interpret user intent. The document version control module enabled centralized file access with modification metadata, reducing the need for manual file sharing. The networking page facilitated direct team communication within the system. Overall, the prototype confirmed that the proposed architecture is functionally viable and that the interface design aligns with user expectations for collaborative event coordination.

4. CONCLUSION

Maestro addresses a practical gap in university event management by combining centralized coordination with an AI-assisted multi-agent architecture. The requirement validation survey confirmed that communication failures, task fragmentation, and the absence of a unified platform are real challenges faced by event organizers. The prototype established a working foundation for full system implementation. Future work will focus on improvising the operational AI agents with distinct roles coordinated through LangChain and conducting user acceptance testing based on real system interaction. The results demonstrate that multi-agent AI architectures can be effectively applied in resource-constrained academic environments to enhance collaborative event management.

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