AI-Supported Collaborative Engineering Design Workspace

Background

The increasing availability of generative artificial intelligence tools is rapidly changing how engineering students approach design projects. While AI has the potential to improve productivity and provide valuable support during the design process, there is growing concern that students may rely on AI-generated solutions without fully engaging in the critical thinking, brainstorming, decision-making, and collaborative problem-solving activities that are essential to engineering practice.

At the same time, instructors often have limited visibility into how teams develop ideas, evaluate alternatives, divide responsibilities, and arrive at final design decisions. Assessment is typically based on final reports and presentations, making it difficult to evaluate the quality of the design process and the contributions of individual team members.

There is an opportunity to develop a new generation of collaborative design platforms that leverage AI to support learning while encouraging independent thinking, teamwork, and engineering judgment.

Project Description

The objective of this project is to design and develop an AI-supported collaborative engineering workspace that enables student teams to document, manage, and reflect on the entire engineering design process.

The platform will provide a shared online environment where team members can brainstorm ideas, record assumptions, perform calculations, upload design files, document design decisions, and communicate throughout the project lifecycle. Rather than functioning as a solution generator, the AI component will act as a design reviewer and learning coach by prompting students to justify decisions, consider alternatives, identify risks, and reflect on their reasoning.

A key feature of the platform will be the ability to monitor and visualize the evolution of team thinking and design development over time. The system will also generate analytics related to team participation and individual contributions, providing instructors with greater insight into team dynamics and project engagement.

The platform should encourage students to complete initial brainstorming and design activities before receiving AI-generated feedback, thereby promoting active learning and reducing overreliance on AI-generated solutions.

In This Capstone Project, the Client Expects the Team to Design the Following

Core Collaboration Platform

- A secure web-based collaborative workspace
- Team-based project organization and management
- Shared brainstorming environment

- Shared engineering design notebook
- Discussion and communication tools
- File upload and management capabilities

Design Process Documentation System

- Design decision tracking
- Assumption logging
- Design iteration history
- Version control and project timeline visualization
- Documentation of alternative concepts and design rationale

AI-Assisted Learning Module

- AI-powered design review assistant
- Guided questioning system
- Reflection and justification prompts
- Feedback on engineering reasoning and decision-making
- AI interaction history and traceability

Contribution Monitoring System

- Individual contribution tracking
- Team participation analytics
- Design activity summaries
- Collaboration and interaction metrics
- Instructor-facing contribution dashboard

Instructor Dashboard

- Team progress monitoring
- Project activity visualization
- Contribution summaries
- AI usage analytics
- Assessment support tools

Optional Advanced Features

- CAD model upload and visualization

- Integration with engineering analysis tools
- Automated design review reports
- Peer evaluation tools
- Learning analytics and engagement metrics

Statement of Value to the Organization

The proposed platform addresses a growing challenge in engineering education: how to effectively integrate artificial intelligence into student learning while maintaining meaningful cognitive engagement and authentic teamwork.

The platform will provide instructors with unprecedented visibility into the engineering design process, enabling assessment of how students think, collaborate, and make decisions rather than focusing solely on final project deliverables. This process-oriented approach supports the development of engineering judgment, communication skills, and professional design practices.

For students, the platform creates a structured environment that promotes active participation, accountability, reflection, and collaborative problem-solving. By positioning AI as a design reviewer and learning coach rather than a solution generator, the platform encourages responsible and productive use of AI technologies.

The resulting system could be deployed across multiple engineering courses, capstone projects, and design-based learning environments, providing long-term value to the department while supporting research and innovation in engineering education and AI-assisted learning.