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WORDS TO IMAGES TO PROTOTYPES: Generative AI Tools for Team Project-based Iterative Prototyping

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Abstract:

Iterative prototyping is a core practice encouraged in engineering, design, and arts curriculums that encourages rapid constructing and testing of low-fidelity prototypes for expressing an original idea. Despite the advantages of obtaining pertinent evaluation from intended user groups that can quickly improve the design, students working in teams often fail to properly undertake the iterative prototyping cycle in classroom projects due to lack of clear envisioning of what the final product to create looks like, and lack of understanding of what specific components of the system need to be modified in each round of testing. This leads to students being overwhelmed by the possible design choices available, leading to stagnation in the ideation-testing process, frequently resulting in procrastination until the deadline arrives.

Recent development of Generative AI (GenAI) technology promises strategies of making abstract designs concrete using both interactive chatbot and text-to-image approaches. Our own publication contributions to the field - AI as Active Writer, and When Teams Embrace AI - pioneered approaches for applying and evaluating both GPT and Stable Diffusion-based tools to inspire, organize, and realize designs in a team-based framework. These tools were shown to engender creativity, promote team discussion in iterative creative tasks, and produce build sketches and plans for subsequent implementation. However, how to tailor these tools for specific use in engineering, design, and arts curriculums to specifically support different components of ideation, design, and evaluation in classroom team project remains unexplored.

WORDS TO IMAGES TO PROTOTYPES is a proposed project to facilitate students in team-based projects in campus-wide courses in engineering, design, and the arts. Students will be immersed in the traditional iterative prototyping workflow that is enhanced by engagement with text-to-text ChatGPT for ideation, organization, and evaluation; and with text-to-image Stable Diffusion to visualize, prototype, and modify their designs for direct fabrication. A selection of courses will serve as research case studies to enact the curriculum. GenAI tools will be applied to each part of the iterative prototyping process in a design-component-specific manner to evaluate advantages, spot potential pitfalls, provide guidance on implementation, promote teamwork, create artifacts for dissemination, and encourage experimentation within the context of rapid development. A campus-wide demonstration of the course outcomes both in process and outcome product forms will encourage student involvement, while a public exhibition and web documentation will publicize the effort to greater Hong Kong education audiences. Like previous efforts, the research will also be published in renowned venues for academic discourse.

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GenAI is changing the way students can apply tools for ideation and teamwork, but its use for prototyping, envisioning, and evaluating designs in team-project educational curriculums remains unexplored. This project aims to apply state-of-the-art processes we publish on to CityU classrooms for increasing student effectiveness, engagement, and dissemination, creating a blueprint for campus-wide activities like innovation incubators and CityU Tiger programs. It also positions CityU as a pioneer in substantiated efforts for leveraging text-to-image and other GenAI tools in team-based educational contexts.