# 4-Frame Manga Drawing Support System

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**ABSTRACT**
This project proposes a 4-frame manga drawing support system that assists users in creating drawings. The proposed system recognizes each frame of an unfinished manga drawn by a user and proposes successive frames, considering the content recognized till then, e.g., the storyline, frame composition, and punchline. The system updates the proposal as the manga drawing proceeds. The proposed system comprises four modules for 1) recognizing the user's drawings, 2) generating four sentences that describe the storyline, 3) generating images, each of which corresponds to a manga frame from the above sentences, and 4) choosing the user-preferred manga candidate from a number of potential choices. The proposed system does not require AI to generate the 4-frame manga; instead, the user draws the 4-frame manga with the help of the system. In other words, the user decides whether to accept or reject the AI's proposal.

**Author Keywords**
Image-generation AI; Image-recognition AI; Claude large language model

**ACM Classification Keywords**
H.5.m. Information interfaces and presentation

**INTRODUCTION**
This project proposes a 4-frame manga drawing support system, in which AI is employed to suggest 4-frame manga ideas to the users, as they create their own 4-frame manga drawings. 4-frame manga is a form of Japanese manga, in which four frames are used to draw a short story. Recently, a project called TEZUKA2023 employed two generative AIs for drawing manga in cooperation with humans. A rudimentary story is first generated by GPT-4 [1], while the character faces and frames are generated by Stable Diffusion [2]. In this proposed system, AI first presents ideas for the storyline and characters; however, the actual frame composition and dialogue of the manga need to be created by the user, referring to the ideas suggested by AI.



The system recognizes each frame of the unfinished manga drawn by the user, and proposes a succession of frames, taking into account the content recognized so far, e.g., the storyline, frame composition, and punchlines. "Silent manga", prevalent in Japan, is a manga without dialogue, and the 4-frame manga handled by the proposed system is limited to "silent manga". While the story of the manga is generated by text-generation AI, the frames of the manga are generated by image-generation AI. With the proposed system, the user first starts drawing a 4-frame manga, as shown in Figure 1. The AI recognizes the user's 4-frame manga drawing and proposes candidates for successive frames. In Figure 1, the user draws two frames of a 4-frame manga, with the ideas "I found a wallet → I took it to the police station". In response, AI proposes two successive frame strips: "go shopping at the supermarket → take out the wallet from the pocket only to realize that it is the one I found earlier" (i.e., the wallet left in the police station is the user's).

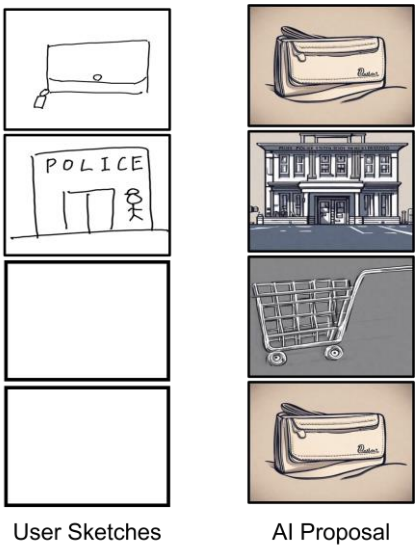


**Figure 1. System overview**

**METHOD**
In the proposed system, as the user starts drawing a 4-frame manga, the AI continuously generates the storyline, frame composition, and punchline, and proposes them to the user. The proposed system requires four modules for 1) recognizing the user's drawings, 2) generating four sentences that describe the storyline, 3) generating images, each of which corresponds to a manga frame from the

above sentences, and 4) choosing the user-preferred manga candidate from potential candidates.

The first module will be developed by employing both image-generation AI and image-recognition AI. As it is difficult to train AI to directly recognize drawings by users, the system generates a photographic image of the object drawn in each frame, employing image-generation AI. The generated image is then converted into an object description text, by employing image-recognition AI. In Figure 2, the user draws two frames that imply "I found a wallet", and "I took it to the police station". The first frame is converted to a photographic image of a wallet and the second to that of a police station by the image-generation AI. The object descriptions "Wallet" and "police station" were obtained from the photographic images of the first and second frames, respectively, by the image-recognition AI.

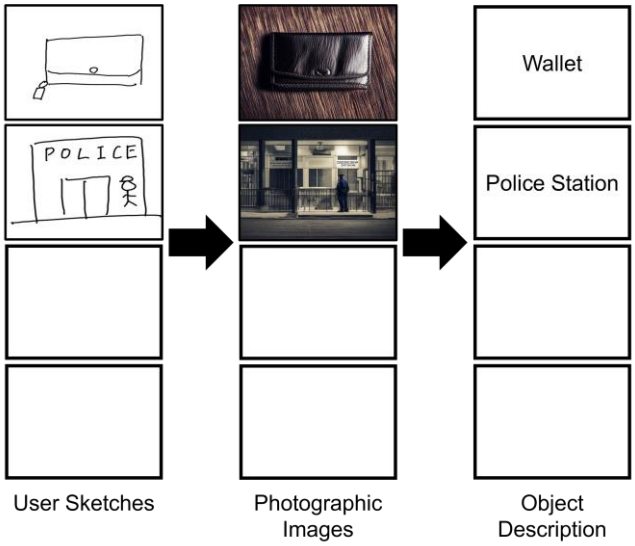


**Figure 2. Module for recognizing user drawings**

The second module will be developed by employing Claude large language model (LLM). The Claude LLM generates a sentence for each manga frame. Thus, it generates four sentences that depict the storyline, given the two object descriptions, which are "I found a wallet", "I took it to the police station", "I went shopping at the supermarket", and "I took out the wallet from my pocket and realized that it was the one I found earlier". Each of these sentences is converted again into an object description of the corresponding frame by Claude LLM as "Wallet", "Police Station", "Shopping Cart", and "Wallet"; this is depicted in Figure 3.

The third module proposes 4-frame manga candidates generated from the object descriptions obtained above using the image-generation AI, as depicted in Figure 4. Such AI proposals will be made interactively even as the user continues the drawing. Finally, the fourth module obtains the "best" candidate interactively by considering the user's actions and facial expressions. The image-recognition AI is employed to recognize the user's facial expressions in real time and ranks the candidates.

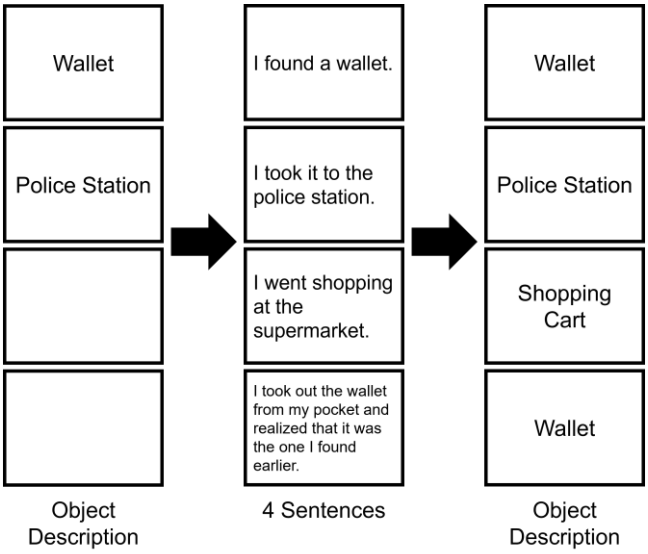


**Figure 3. Module for generating four sentences that describe the storyline**

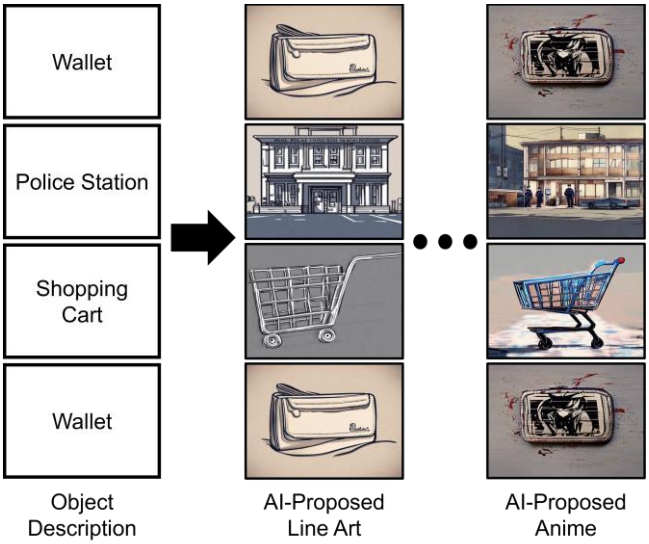


**Figure 4. Module for generating images, each of which corresponds to a manga frame from the sentences generated in the third module**

## CONCLUSION

We propose a 4-frame manga drawing support system that employs AI, and recognizes a user's drawings, generates four sentences that describe the storyline, generates images, each of which corresponds to a manga frame from the above sentences, and finally chooses a user-preferred manga candidate from a number of potential choices. With the help of the proposed system, users can generate their own manga drawings.

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