**PROJECT PROPOSAL**

| **Date of proposal: 15-September-2023** |
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| **Project Title: RoomifAI: Interior Design Visualizer** |
| **Group ID (As Enrolled in Canvas Class Groups): Group 5**  **Group Members (name , Student ID):**  Kwatt, Ivy (A0269639H)  Chua, Jack Yune (A0269363U)  Yeoh, Wee Chee (A0165226H)  Borromeo, Angelie Quiapo(A0270177A) |
| **Sponsor/Client:** *(Company Name, Address and Contact Name, Email, if any)*  N/A |
| **Background/Aims/Objectives:**  The primary objective of this project is to provide interior design visualizations using a quick and easy method. Through textual prompts and an interactive graphic user interface, users can generate images of beautifully-designed room interiors based on their desired style or specifications. Conventional methods of generating interior design concept drawings require a professional designer to gather reference images, produce 2D designs and 3D modeling and rendering. This process will undergo further refinement and feedback from clients, which is time consuming.  The proposed tool allows the general user to generate interior design concept art without in depth knowledge in the interior design domain, while being able to work out different design ideas through the use of textual prompts.    For professionals, the tool can be used to quickly and easily generate multiple prototype proposals to elicit client feedback, to be used for marketing or before moving on further along the design pipeline. The motivation behind this tool is to make room staging readily accessible, and easy to use, through the integration of deep learning technology. |
| **Project Descriptions:**  **Introduction**  The tool provides potential value for interior designers, real estate agents or developers aiming to enhance visual representations for clients by presenting preliminary concepts/prototypes of any particular room design, whether to better market a property, or to present design ideas for clients wishing to refurbish their homes. Additionally, it could cater to initial requirements of various professionals like interior designers, bathroom designers and fitters, event organizers, kitchen designers, property photographers, and other related domains. The tool provides a foundational layout along with potential designs, finishes, and furnishings to enhance visual appeal.  For the project purpose, the tool will be used for bedrooms, living room, kitchen and bathroom, with potential development for other types of rooms.  **User Flow**  *Figure 1 Process flow*      The tool aims to accomplish this by furnishing an initial two-dimensional environment, materializing from the following methods:   1. user's textual input denoting their requirements, for e.g “bedroom with 1 queen size bed and cabinet and full length window” 2. from user-uploaded imagery. The image will then be matched with appropriate captions from an image captioning tool. 3. optional input from the user's masking on a particular area on the generated image/uploaded image, in order to replace it with another item of interest. The latter method capitalizes on inpainting capabilities with the use of image segmentation, thereby updating the image in accordance with the user's stipulated prerequisites.   This function essentially serves as the bedrock upon which users can erect their innovative ideation.    **Method and Technique**  Central to the project's goals is to leverage Stable Diffusion v1.5 (SD1.5), a diffusion-based image generation model through textual prompt inputs, which will be adeptly fine-tuned through the utilization of existing technologies such as DreamBooth and LoRA (Low Rank Adaptation). Furniture and room layout images from a selected brand, i.e. IKEA, will be used for fine-tuning of the model.    To allow users to easily select elements in the room to further apply Stable Diffusion inpainting, we will use SegFormer, a transformer-based image segmentation model, to segment objects in the image, e.g. chairs, tables, cupboards, and allow users to select these segments for editing. A segmentation mask will be applied onto the image and inpainting will be used to regenerate the selected regions. The model will be fine-tuned with our own labeled dataset, similar to the Stable Diffusion model above.  For the user-interface/front-end we will be using Python Gradio, and for the backend, an API built with the Flask framework.  **Data Sources**  Datasets used for training and fine tuning the models will be taken from readily available scraped furniture datasets from Ikea catalogs.  We utilize a combination of BLIP2 image captioning, scraped catalogs with product descriptions and human labellers to provide the captions for the images which will be used later on for training and fine tuning the Stable Diffusion pre-trained model. |