Final Report

PROJECT TITLE	Neural Canvas, an AI Art Picture Frame		
SUBMITTED BY	Jeff Cooper, Ian Cox, Chase Melisky	**PROJECT TYPE**	Art and Technology
CLASS	CS2210: Computer Organization	**GROUP #**	24
DATE OF PROPOSAL	Oct 13	**TOTAL ESTIMATED BUDGET**	$2154.98
START DATE	Sept 15	**PRESENTATION**	Dec 4

FINAL REVISIONS

FUNCTIONALITY

In our final version of Neural Canvas, users can initiate prompt input by using wake words, the default being "picture frame". Users can also use the name of various artists as the wake word for their image to be displayed in that artist's style. Upon verification of the wake word, the user is then instructed to speak their prompt. The prompt can be as long and as in-depth as they desire. The program will begin generating the image once the user has finished speaking their prompt. The generated image is then displayed onto the picture frame. The image will continue to be displayed until the user provides another wake word.

Neural Canvas uses the SpeechRecognition Python library for both the wake word and voice prompt functions. For image generation, the spoken prompt is fed into OpenAI's API to utilize DALL-E 3's image generation capabilities. Feh image viewer is used to take the saved images and open them for display on the screen. After the image is displayed, the program loops back and waits for another wake word.

PROJECTED TIME VS. ACTUAL TIME

We stayed on pace for completion throughout the project timeline. Our projected completion date was November 27 which we reached. The following days involved optimization of speech recognition and image outputs. Much of this project involved research on the best way to do certain tasks within our program. With this in mind, conducting a higher volume of research towards the beginning of the timeline would have given us a more optimal route in completing our project. Instead, we essentially went through multiple versions before coming to our final design. We would have saved time if we had researched then started developing our project. In all, we did complete our project within our projected time although we learned important lessons on time management moving forward with future projects.

COST ANALYSIS

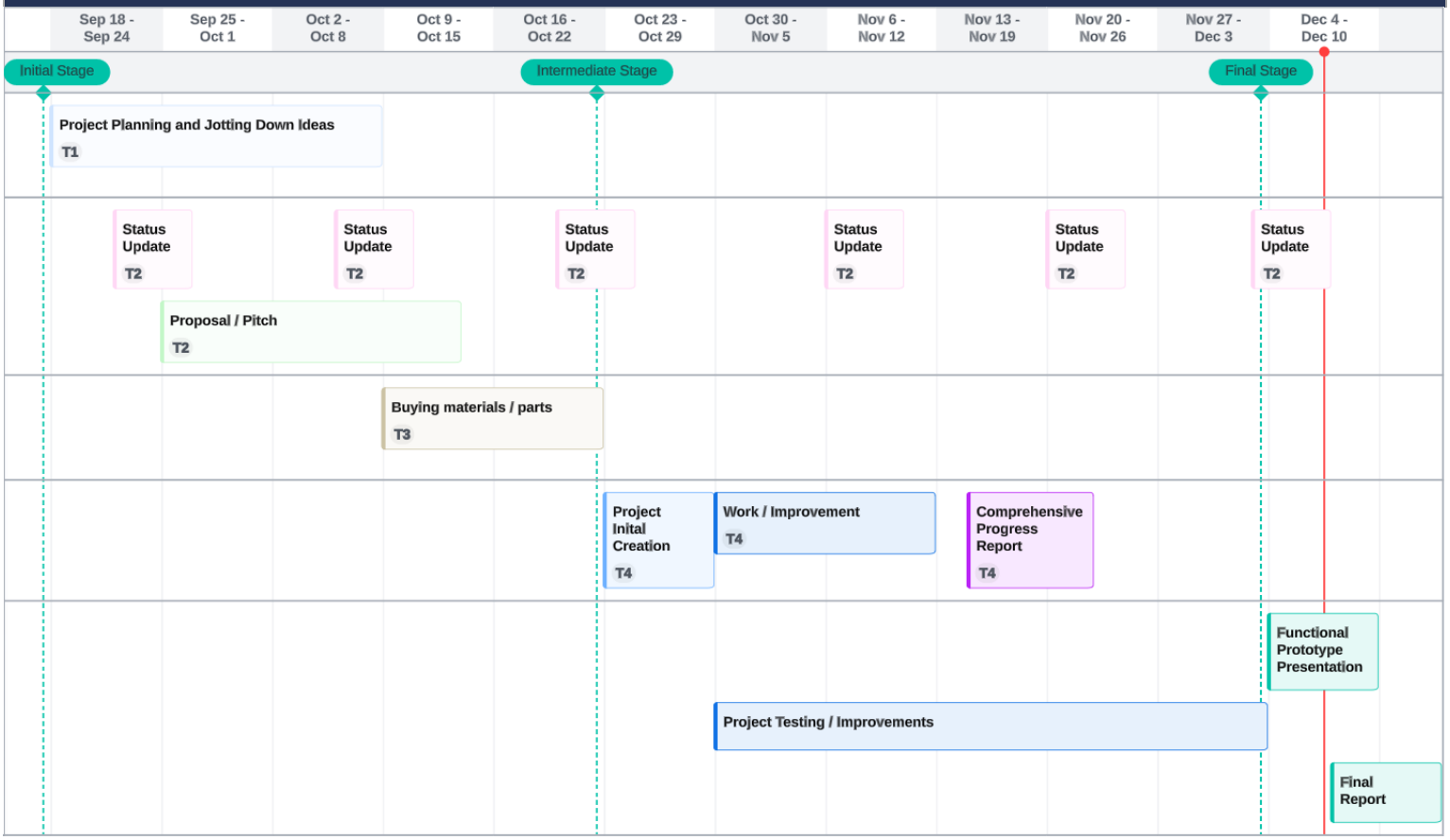
Cost of materials was fairly accurate. Image generation ended up costing $10 due to the amount of testing that was done. Picture frame also cost about $15 rather than the initial estimated $10. In terms of materials, we were a few dollars **over** budget.

Labor costs were overestimated as the large majority of this project involved software development. There was not much labor necessary for assembling and constructing the physical project as it only involves a screen, microphone, and picture frame. In terms of labor, we were **under** budget.

TIME LOG

DATE	NAME(S)	ROLE	DESCRIPTION	TIME (hrs)
Oct 14	Jeff	Project Manager	Secured API key for AI image generation	1
Oct 16	Ian	Hardware Dev	Researched necessary hardware	1
Oct 18	Chase	Software Dev	Tested image generation in the terminal	1
Oct 25	Ian, Chase, Jeff	All roles	Bought all materials needed	1
Nov 1	Ian, Chase, Jeff	All roles	Tested screen set up with pi, created python files	2
Nov 8	Jeff	Software Dev	Tested image output with text prompts	2
Nov 14	Ian, Chase, Jeff	All roles	Meeting to discuss next steps and current challenges. Testing	1
Nov 21	Jeff	Software Dev	Implemented speech prompts	3
Nov 28	Jeff	Software Dev	Implemented wake words	3
Nov 30	Ian	Hardware Dev	Assembled the display	2
Dec 2	Chase, Jeff	Project Manager, Software Dev	Final program optimizations	2
Dec 3	Ian, Chase, Jeff	All roles	Final meeting. Discuss presentation	1

UPDATED GANTT CHART



MEMBER CONTRIBUTIONS

Software development was conducted by Jeff with Chase supplying resources, references, and technical oversight along the way. Ian managed hardware devices as well as display and functionality. Collectively, all members participated in group discussions and testing stages along the project timeline. All members gave feedback, offered solutions and ideas, and stayed on top of deadlines for project checkpoints.

REFLECTIONS

JEFF – Project Manager

My experience with this project has been extremely beneficial. The most notable achievement was the integration of voice recognition. The sense of accomplishment when our first voice recognition image was generated was thrilling. With all the successful checkpoints achieved along the way, there were just as many challenges. Troubleshooting became the most time-consuming aspect of this project. Most challenges were overcome by finding a different approach to what we were trying to achieve while some issues such as memory allocation were simply out of our control. With this being said, the challenges allowed for growth in troubleshooting and technical review skills. This project enhanced my understanding of external APIs, working with libraries, and sub processing.

Testing stages were both a necessary and fun aspect of our project's development. Playing around with the capabilities of OpenAI's DALL-E 3 always kept us enjoying the process. Completing this project makes me excited to create more in the future. Knowing that we were able to complete this project in a timely manner makes me hopeful for some of the other ideas I have had. Now moving forward, I can use the lessons learned from this project to guide myself in the development of more programs and applications.

CHASE – Engineer

My experience in being a part of the creation of Neural Canvas was, in a word, enlightening. It has been incredibly gratifying seeing hours of work and ideating come to a functional fruition, and one that looks like it could be a real product, at that. The labs that were part of CS 2210, as well as this project, were the first time I saw physical manifestations of the coding and designing that I'd been doing in the computer science field- to be able to run a program and have an inert picture frame turn into an idea we had months ago is pretty awesome. Challenges such as running into walls, whether creatively or during the process of coding this project, were present. However, this project showed, for me, that nothing is usually too hard to accomplish when it comes to this field. Doing research to figure out how to optimize stuff like the speech-to-text API or the effectiveness of the wake-words and transcription showed us that while there may be someone doing the same thing as you, there's almost always a more efficient way to do it.

IAN – Engineer

Having participated in the Neural Canvas team and immersed myself in the AI:artframe Project spanning the past semester, I've gathered valuable insights. The challenges we encountered included the coordination of meeting times among team members, aligning with everyone's schedules, and the time-consuming process of individually acquiring all the project components. Additionally, ensuring the accuracy and timeliness of the mini microphone's response to our prompts and seamlessly integrating the screen and wiring into the picture frame posed notable challenges.

Reflecting on the experience, several key takeaways emerged. The enjoyment and fascination of working with DALL-E 3 underscored the project's creative and engaging nature. Witnessing AI's ability to generate images based on keywords rapidly highlighted the technology's efficiency. The integration of Raspberry Pi with OpenAI proved to be a relatively straightforward process. Collaborating within a group proved vastly superior to solo work for numerous reasons. The synergy of bouncing ideas off each other and collectively deciding on project aspects, such as the design of slides leading up to image generation, significantly enhanced the user experience and professionalism of our endeavor. Troubleshooting, particularly on the programming side, would have been considerably more challenging without the support of teammates.

In conclusion, I found the experience highly rewarding and would eagerly embark on a similar project again. It serves as a valuable opportunity to assess the evolution of my Raspberry Pi skills and effectively apply recently acquired knowledge from computer organization to a project at the forefront of modern technology.

VIDEO DEMONSTRATION

Neural Canvas Video Demonstration

CITATIONS

Image Generation: OpenAI's DALL-E 3 https://platform.openai.com/docs/guides/images?context=node
Speech Recognition: Google Speech Recognition https://pypi.org/project/SpeechRecognition/
Image Viewer: Feh https://feh.finalrewind.org/