A voice cloning machine learning model receives a speech and text input and creates a new speech output reading the text input in the voice of the speaker input. Such a voice cloning procedure used to need nearly an hour of audio to create a realistic cloned voice; however, recent advances in machine learning research using an SV2TTS model has lowered the necessary audio to around 5 seconds. The SV2TTS model is composed of three components consisting of a speaker encoder, a synthesizer, and a vocoder. Since the SV2TTS model is composed of three submodels, it requires a large number of parameters, is computationally expensive, and is slow to both train and runs, preventing its use for low-end systems.

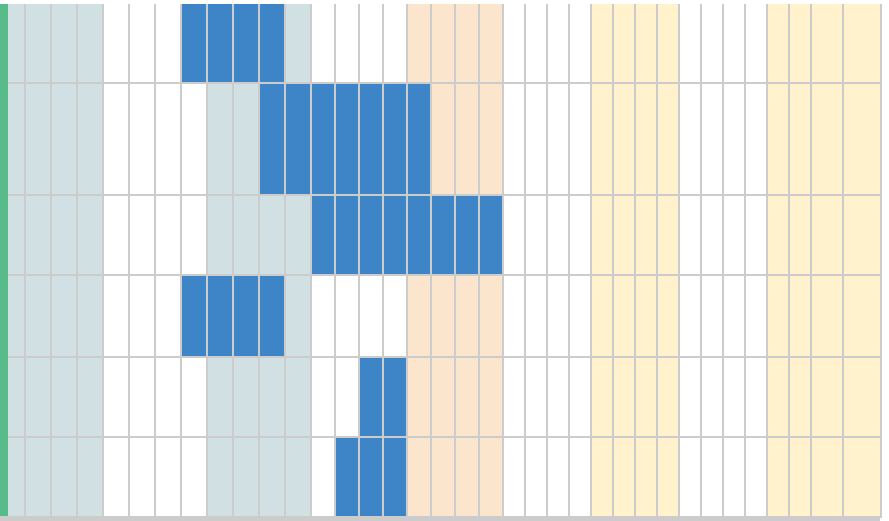
Our project is called "Compute Efficient Real-Time Voice Cloning" and aims to both speed up and reduce the computational resources necessary to provide a voice-cloning model that will be uploaded to a low-end system. To achieve this objective, we divided our project into three separate stages:

- Implement a modified version of VITS called YourTTS, a new state-of-the-art voice cloning model to the "ESPnet" repository.
- Implement memory and processing optimizations such as quantization.
- Upload the final model to a low-end system and create additional peripherals for users to interface with the system.

The ESPnet repository is a machine learning toolkit used to speed up the productivity of machine learning engineers. By using a modified YourTTS model in ESPnet, we gain access to an improved training and evaluation environment that is more accessible to a broader audience. The low-end system we use in our system is a Raspberry Pi 4, a versatile microcontroller used in many electronic system applications. The peripherals consist of a miniature button keyboard with an attachable display and a microphone for user inputs, and a speaker for a cloned voice output. Each of these peripherals was designed and implemented on a PCB.

Since the project's inception, our team has learned the basics of deep learning, learned to train and evaluate machine learning models using ESPnet, and learned to quantize and deploy the YourTTS voice-cloning model to a real-world application. Regarding hardware, we have designed schematics for the system peripherals and have performed extensive tests to analyze the microcontroller's ability to run machine-learning models. Outside of our technical accomplishments, we were able to outline and follow a timeline for a long-term project while also exhibiting good communication skills amongst ourselves.

TASK NUMBER	TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION	PCT OF TASK COMPLETE	ECE 441													ECE 442										ECE 443										
							October					November				December					January				February				March					April				May				June			
							2	3	4	5	6	7	8	9	10	11	WB	WB	WB	1	2	3	4	5	6	7	8	9	10	11	SB	1	2	3	4	5	6	7	8	9	10	11
1	**Research and Planning**																																								
1.1	Read Chapters 5-10 of Deep Learning Textbook	Everybody	10/3/2022	11/11/2022	39	100.00 %																																			
1.2	Read SV2TTS Research Papers	Everybody	10/10/2022	11/11/2022	32	100.00 %																																			
1.3	Verify SV2TTS Github Repository Implementation is Correct	Matthew	10/3/2022	10/14/2022	11	100.00 %																																			
1.4	Hardware Schematic Design	Connor & Micah	11/10/2022	11/25/2022	15	100.00 %																																			
1.5	Familiarize Yourself with ESPnet Code	Everybody	11/14/2022	11/25/2022	11	100.00 %																																			
1.6	Verify Microcontroller runs SV2TTS model	Matthew	11/21/2022	12/2/2022	11	100.00 %																																			
1.7	Create Comprehensive Research Document	Everyone	11/14/2022	12/9/2022	25	100.00 %																																			
2	**Implement and Test**																																								

2.1	Implement YourTTS model into ESPnet	Matthew	11/20/2022	12/20/2022	30	100.00 %	
2.2	Optimize YourTTS model with updated submodels	Matthew	12/20/2022	2/1/2023	43	100.00 %	
2.3	Implement Quantization	Matthew & Grant	1/9/2023	2/28/2023	50	100.00 %	
2.4	Design Interface PCBs	Connor & Micah	11/20/2022	1/20/2023	61	100.00 %	
2.5	Order Interface PCBs	Connor & Micah	1/20/2023	1/27/2023	7	100.00 %	
2.6	Create an Enclosure	Everyone	1/9/2023	1/31/2023	22	100.00 %	
3	**Refine and Finalize**						
3.1	Verification and Testing	Everyone	2/1/2023	3/20/2023	47	100.00 %	
3.2	Documentation of Progress	Everyone	1/9/2023	5/20/2023	131	100.00 %	
3.3	Present Work	Everyone	6/1/2023	6/1/2023	0	0.00%	