The process of enhancing and modifying this project was from a basic thermostat to a multifunctional system that includes a musical piano with recording capabilities. This challenged me to think critically about system design, user interaction, and hardware limitations. Initially, the thermostat function focused solely on temperature regulation using a state machine. Adding the piano feature required careful integration to ensure both subsystems could operate concurrently without interfering with each other.

I had to rethink my approach to concurrency and responsiveness, which led me to implement multithreading for display management and playback functionality. The piano feature introduced additional complexity, including accurate time stamping for recording, LED synchronization, and sound playback without delay. Each modification forced me to evaluate how new components would impact performance and usability. I also had to avoid GPIO conflicts and optimize the use of system resources to ensure smooth operation.

Throughout the process, I gained a deeper understanding of the trade-offs between functionality and system responsiveness, particularly in an embedded environment with limited computing power. I also recognized the importance of writing clean code.

My process for modifying the Raspberry Pi involved a lot of research to understand how to get everything working correctly. One of the challenges I faced was figuring out how many buttons I could connect to the board at once. I initially planned for more, but due to GPIO limitations, I was only able to use six buttons for the piano keys and one additional button for recording and playback. Implementing the playback feature was also something I had never done before, so I encountered several issues as I learned how to record and accurately replay the button presses in sequence.