Gabe Howland

Thesis Introduction

11/15/24

This thesis explores lighting control, specifically for live performance. It will take a look at how lighting was originally controlled manually, how the technology has advanced to today through the use of time coding, and proposes a system for control that is reactive to a performer. Lighting control has advanced at a breakneck speed over the past half-century as the world entered a digital age. Where lighting control rooms were packed with levers and room-scale dimming racks now sit lighting desks, or even just a laptop. As the technology for controlling lights has advanced, the lighting design for live performances has gotten more complicated, while being largely pre recorded. Thus, while a designer's vision is accomplished in collaboration with the director and performers, it stays static barring catastrophe, which introduces interesting problems. Consider the actor who moves in tandem to a moving light. This is usually accomplished through hours of rehearsal, and fine-tuning movements in order to keep pace with the light. However, if the actor in a particular showing wanted to modify a movement, either in the route or in the speed, they would be constrained by the lighting.

This thesis attempts to alleviate those constraints by creating a lighting control scheme that tracks a performer through a theatrical space. It is a reactive scheme that hopes to meet a few criteria: 1) The scheme must be lightweight; 2) The scheme must be able to run using off-the-shelf components and computing resources; 3) The scheme must be open source; 4) The scheme should run on top of existing theater infrastructure. It is worth mentioning that this concept is not revolutionary. There are numerous choices for high-end performer tracking offered by the likes of Cast Group's BLACKTRAX, Follow-Me, and zactrack. However, these systems are often closed-source, prohibitively expensive, hardware intensive, or otherwise difficult for small productions to access. The software developed during this thesis hopes to try to make it easier to access, which is why the scheme has criteria.

This thesis is spread across three(?) chapters. The first is a literature review of the theory and practice behind lighting control. It will start at the very beginning, mechanical ropes and pulleys, hiding and revealing gas lamps, all the way to the modern control systems that run live performance today. It will look at how the jump from analog to digital control marked a shift in the complexity of lighting design. It will explore how this technology differs over productions of different sizes with the theory that that technology often “trickles down” from high-end productions (concert tours, sporting events, Broadway, etc.) to low-end, and most technology is manufactured for the arenas, concert venues, and other performance spaces who can pay the premium.

The second and third chapters look at this thesis with a different perspective, namely as a series of computational problems. The second will be an exposition of the different computational problems that come with tracking a performer, and what was done to solve them. These problems are, including, but not limited to, tracking the performer, positioning the moving light, and communicating to the lights in question. Meanwhile, the third chapter will dive into the theory behind the openCV library, which is the library that I use throughout this thesis. It will also present a way to calibrate the software for any space.

The fourth chapter will explore the culmination of the work done in the previous two chapters that will be presented in a lighting design for the Dance thesis of Beier (Belle) Li. Li's thesis (presented in February, 2025) explores the various topics of "mother" through three lenses: her own mother, her mother language, and her mother country (being Mandarin and China respectively). [More will be in this paragraph as I develop work alongside Belle.] It will also discuss the logical next steps, which largely remain with packaging the software for consumer use, and other uses for this software.