

**Thesis Project Portfolio**

**RGB – Automated Guitar Robot**  
(Technical Report)

**Autotune’s Impact on Music Aesthetics**  
(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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## Executive Summary

Automation has been a technology that is developing over the years for the purpose of higher efficiency. Production lines in manufacturing industries are automated to achieve higher productivity and freeing workers from dangerous operations. Music industry is also under the influence of automation technology development. For example, MIDI technology allows musicians to incorporate millions of sound effects in musical production. Autotune technology is invented to not only add sound effects to human voices but also correct pitches when needed. Examples of automation like these have led to change in musical aesthetics of the general public. Hence, the prevalence of automated musical technology highlights the need to examine its influence on musical preferences and tastes of the general public. Therefore, the general question of both projects can be raised as such: to what extent automation technology influences the music industry? In my technical project, the focus will be more on how automation technology can be applied to build an automated guitar player robot, which can be used as an educational tool for guitar beginners. As a Computer Engineering student, knowledge of embedded system design, computer networks, software development, and circuit design will be extensively applied. On the other hand, my STS research project focuses on how autotune (an example of automation technology in the music industry) influences the music aesthetics of different music listener groups in the U.S. and China.

As mentioned above, my technical project investigates how to build a music educational tool that automatically plays guitar chords with user inputs. Users send out chord information by typing in a text box within a software application. Then the information will be transmitted via bluetooth module to a microcontroller, MSP430, which is connected to a designed PCB that sends corresponding signals to relevant servo motors that can perform basic motions like plucking, strumming, and fretting. The software application with bluetooth access is implemented with Python libraries. The Bluetooth module is connected to designated pins on the MSP430 board to receive signals. The PCB is designed mainly by multiple 3-to-8 demux modules that break down the binary code sent by the application to decimal. The servo motors are placed at appropriate places above frets and strings to perform basic guitar functions. Some wood blocks were crafted to help achieve this goal as well. The final result, according to the test plan, turns out to be pretty good, as all diatonic chords can be played, all motors function properly, and the GUI application is user-friendly. They fit perfectly with the pre-designed grading criteria.

For STS research paper, as illustrated above, the goal is to investigate the autotune's impact on music aesthetics in the U.S. and China. The importance is obvious, as there have been complaints on autotune, the result of this research paper can help readers understand better why such complaints exist and how autotune shapes pop music industry in both countries under different cultural contexts. With online music streaming data and literature reviews, I investigated famous examples of autotune usage in certain albums of well-known singers in the U.S. and China, such as T-Pain and Taylor Swift in the U.S. and Kris Wu in China. The results

show that in both America and China, the acceptance of autotune technology depends on the extent of its usage, as overuse potentially leads to lower chance of acceptance. However, since the Chinese music industry has been historically learning from the West, the lag in time shows that the autotune technology was only recently introduced and not maturely utilized. Hence, the general acceptance of autotune technology in China is generally lower. Whereas in America, the autotune effect is more broadly welcomed, even though uncreative overuse is not accepted.

Overall, I believe that I have mostly achieved what I set out to do, especially for the technical project, where not only did I have rich experience with teamwork and communication, but also I extensively reviewed all the concepts and tools I learned in my past four years of Computer Engineering study. It is extremely fruitful and rewarding for my future career endeavors. As for future work, there could be multiple suggestions: there could be more features for guitar functions, such as muting and more strumming patterns. There could also be better replacement of servo motors for the purpose of higher durability and resilience. As for the STS research project, I believe that I have reached the goal lay out in the prospectus. The basic goals were achieved; however, there could be more investigations in more examples, as one or two singers cannot represent the whole pop music industry in a country. In addition, there could be more literature reviews from music theory standpoint to analyze the effects of autotune sound in the music. As for future research, one could not only incorporate more representatives of singers who use autotune, but also could discuss more in detail on each music listener group's aesthetics.