Engineering Design Project 2024-25

Pinewood Lamp

Taipei Municipal Zhong-Lun High School

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Project Overview

01 Project Overview

Growing up, I've always been obsessed with Iron Man—his creativity and ability to bring mechanics to life captivated me. I then decided to build an Iron Man lamp to adorn my room and serve as a daily reminder to innovate.

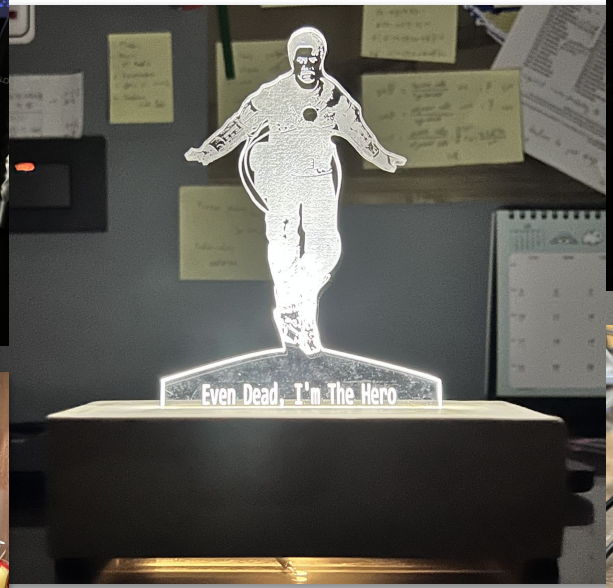
For this project, I started by finding a high-contrast Iron Man image (Fig. 1) online, which was ideal for scanning and cutting. Using Inkscape, I converted the image to a bitmap—a black-and-white format suitable for laser cutting. This allowed me to transform the design into an acrylic board.

Next, I carved a base out of pinewood, carefully reassembling it to support the acrylic board. Inside the base, I soldered a light strip to illuminate the design, bringing my Iron Man lamp (Fig. 2) to life.

Fig 1. Iron Man Pic

Fig 2. Iron Man Lamp

*Pictures of the Iron Man Lamp from different angles and other components



02

Design Process

02 Design Process - Pinewood Base

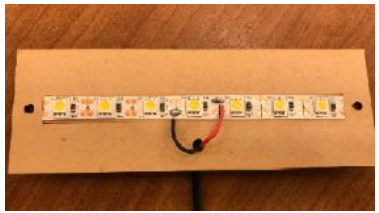
Pinewood Base

- Assembling

- 1. Cutting pinewood strips using a jigsaw
- 2. Assembling the pieces with wood glue
- 3. Attaching the plate to hold the light strip to the baseboard

Securing the light strip and base using Parker screws

- Soldering Light Strip

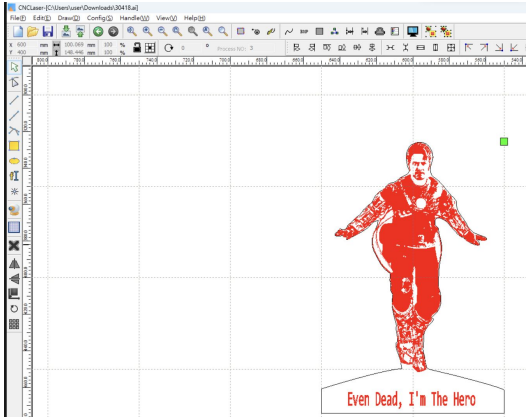


- Materials: Base plate, light strip, USB cable with switch
- Solder the black wire of the multi-core cable from the USB end to the **5V- copper foil** of the light strip
- Solder the **red** wire of the multi-core cable from the USB end to the **5V+ copper foil** of the light strip

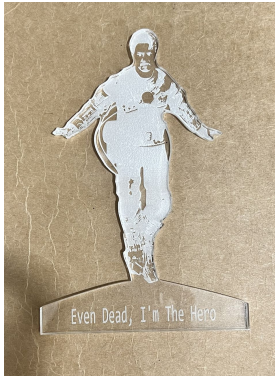
02 Design Process - Iron Man Acrylic Board

1. Using Inkscape to create the outline

2. Converting the design to DXF (Drawing Exchange Format) using Inkscape.



Acrylic Board



3. Setting the layer, size, and drawing the bottom layer in CNCLaser

4. Exporting the .ai file and using the laser cutting machine to cut the acrylic and create the board

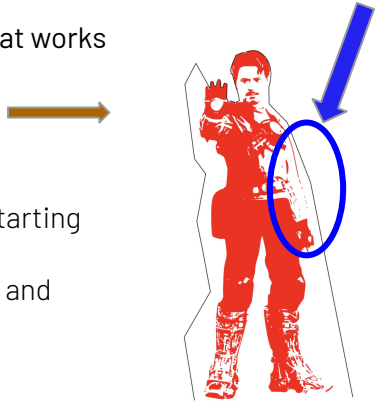
03

Improvement

03 Improvement

Problem 1: Spending too much time finding a good picture

- I spent around 30 minutes to find a good pic, as it was hard to find a picture with high contrast that works well with light.
- The right hand of the first Iron Man pic I found was nearly invisible because the line is too thin.



Solution 1:

Although I couldn't apply this solution to the current project since it's already complete, I believe a good starting point is crucial. If I had found a better picture earlier, I would have had more time to refine and adjust the Bezier curve for my Iron Man acrylic board. This would have allowed me to make the design more delicate and precise within the available class time.

Problem 2: The original Iron Man has too many details

- The Iron Man picture I chose had too many intricate colors and layers.
- When converted to bitmap form, many sections became clustered together, making it difficult to clearly recognize the image as "Iron Man" on the acrylic board.

Solution 2:

I manually removed certain details and adjusted areas like Iron Man's hands and feet to ensure the image was visually clear and recognizable.

03 Improvement

Problem 3: The Margin Between the Wood Strips Is Too Large

- When cutting the wood strips, the measurement wasn't precise enough, so there was gaps between the wooden strips of the base.
- The gaps between the wooden strips of the base were too wide, which disrupted the overall appearance of the design.

Solution 3:

I sprinkled pine wood chips into the gaps between the strips to fill them. Then, I applied carpenter's glue lightly over the wood chips to secure them in place. Finally, since the color of the dried glue was different from the natural pine, I used sandpaper and a disc sander to smooth the surface and make the color of the pine base uniform.

Clearly visible margin

More enclosed and polished

04

Learning Outcome

04 Learning Outcome

The last time I worked with pinewood was probably five years ago in middle school, and I enjoyed it. With a maker's spirit, it's truly satisfying to build something from scratch. The hardware side of things is something I don't usually work with, as I mostly focus on software. Hardware requires materials and space, which makes it a unique and exciting challenge for me.

From laser cutting my own keychain, to making a stamp, and even building a pinewood lamp, I've learned the basics of working with CNCLaser and Inkscape. I've discovered how to find an image online and transform it into something tangible. This is a skill I've long yearned for, and I'm excited to explore more of the hardware side of computers as I pursue my career as a computer engineer.

Taking a "sort of" gap year during my junior year made it a bit harder to connect with my current classmates, especially since most of them are busy preparing for the college entrance exam in their senior year. I've also been occupied with college applications. There's barely any time during breaks to mingle with others and get to know them better. Even when I do talk to someone, it often turns into a conversation about tests and exams—either they're asking me questions, or I'm asking them.

Fortunately, I've had the chance to work closely with other students in this Engineering Design class. We're required to move around and work together on tasks. Whenever I run into something confusing, I simply ask the person next to me and get an answer right away. This class has been invaluable to me, as it not only teaches me the technical aspects of engineering with tangible results but also helps me connect with my classmates better.

Looking Forward to More Projects.....

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