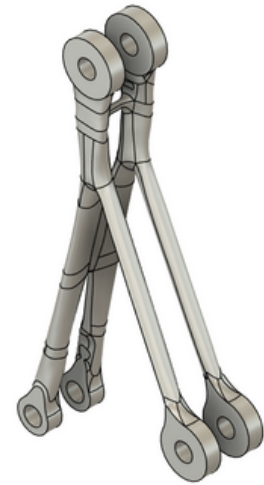
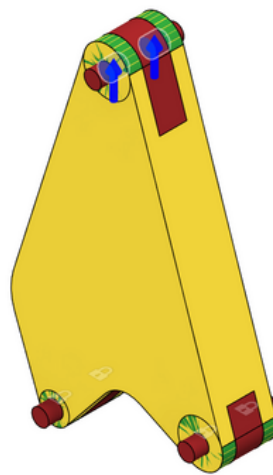
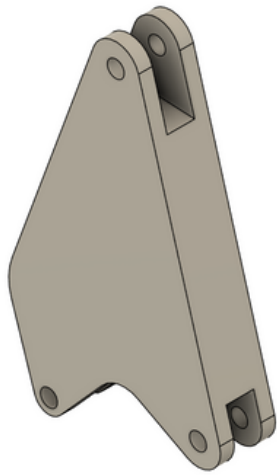


OPTIMIZATION OF AERO-BRACKET FOR LASER POWDER BED FUSION



What?

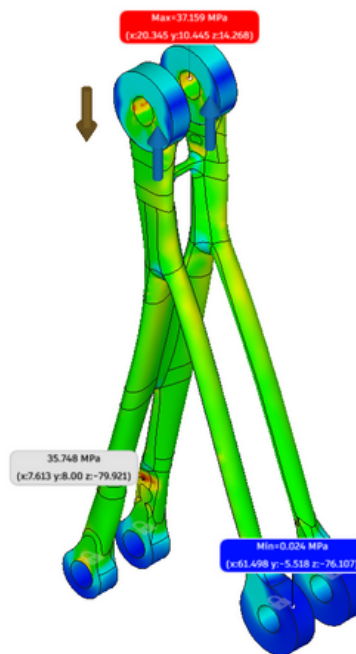
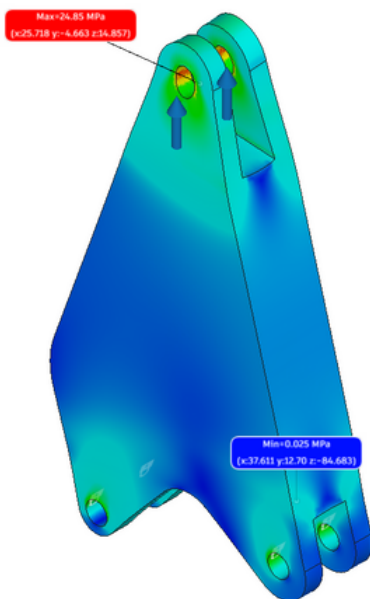
- Optimized an aerospace bracket for **LP-PBF** manufacturing
- Aimed to minimize mass while ensuring safety under a **1600 N** tensile load

How?

- Used Fusion 360 **Generative Design** to create an optimized **AlSi10Mg** structure
- Validated **FEA** results using hand calculations and physical tensile testing

Results

- Achieved **86%** mass reduction (223 g to 31 g) with a predicted **Safety Factor of 6.5**
- Withstood **9018 N** without failure, confirming a **safety factor greater than 5.6**
- Calculations confirmed peak stress of **~209 MPa** remained safely below the **460 MPa** limit



1

PRESERVE AND
OBSTACLE
GEOMETRIES

2

SETUP LOADS AND
CONSTRAINTS

3

OBJECTIVES AND
MANUFACTURING

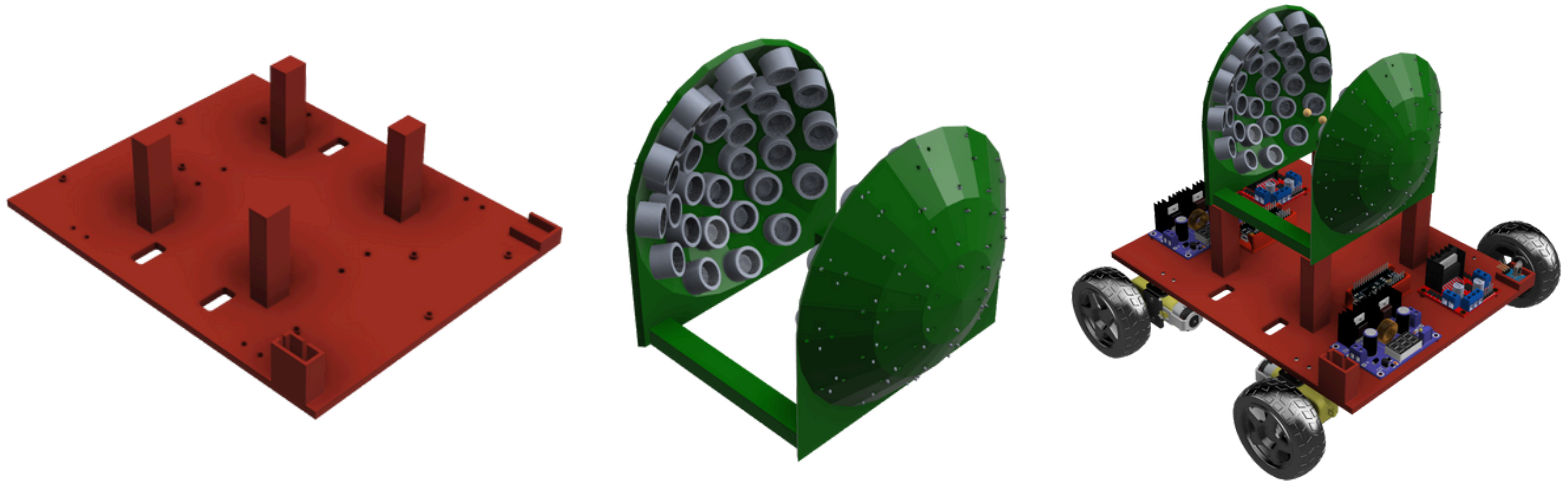
4

MATERIAL
SELECTION

5

EXPLORE
GENERATIVE
DESIGN

TRANSPORTATION VIA ULTRASONIC LEVITATION SYSTEM



What?

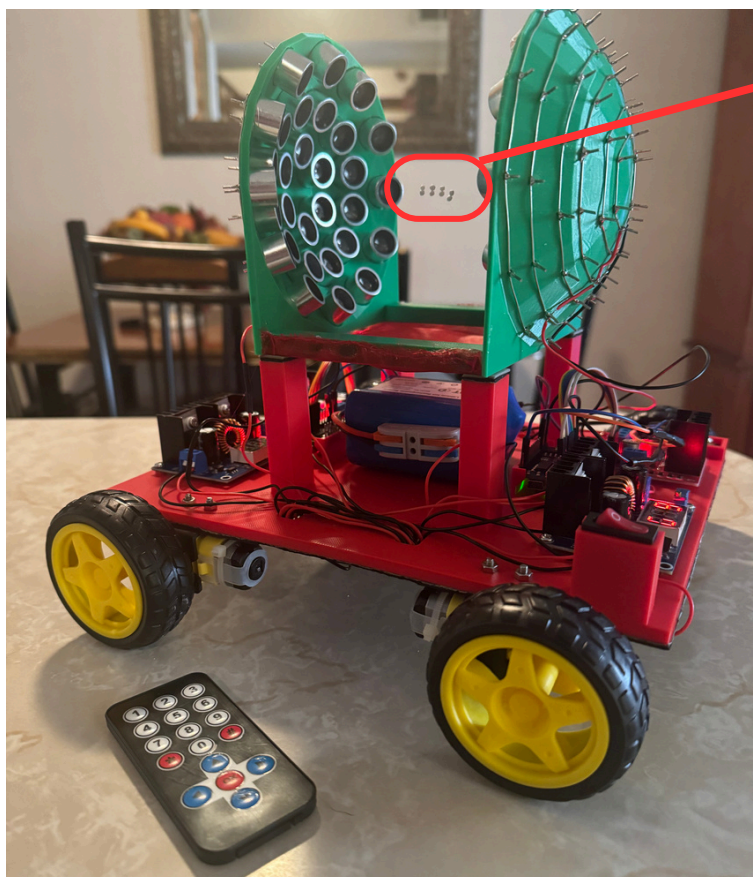
- Created a transport system using **ultrasonic levitation**
- Focused on demonstrating non-contact object handling using a parallel array of **60 ultrasonic transducers**

How?

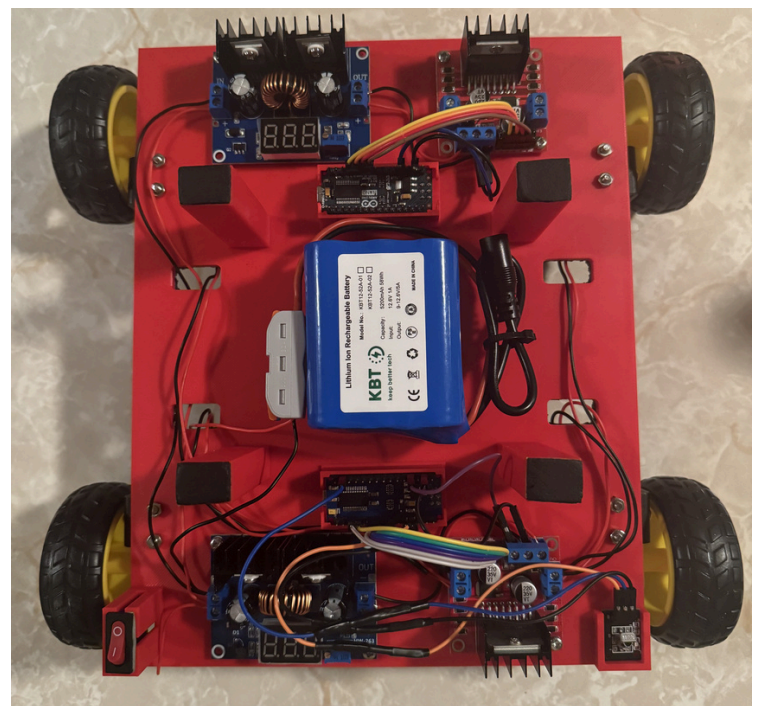
- Configured **Arduino Timer 1 interrupts** to synthesize **40 kHz** acoustic standing waves, eliminating main-loop blocking to ensure levitation stability
- Used Fusion 360 to design a custom **3D printed** base for stability and transportation of the system

Results

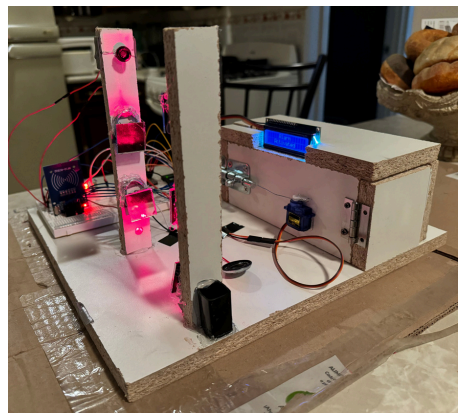
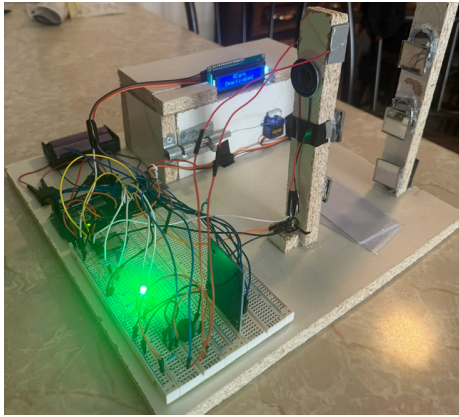
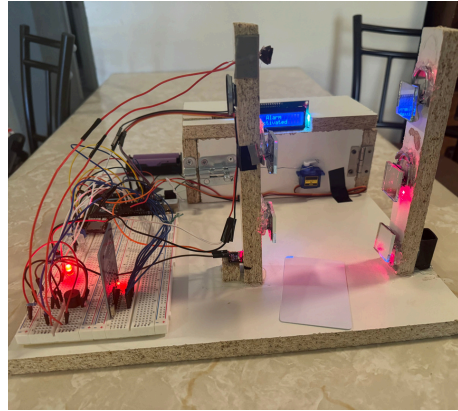
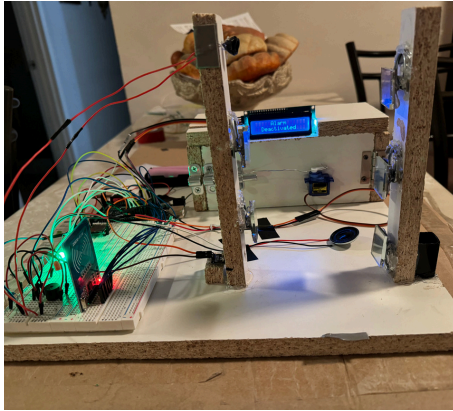
- Achieved stable levitation of micro-components (**<5 mg**) validating precise non-contact handling capabilities using custom driver integration
- Enabled precise remote control for object movement
- Demonstrated effective non-contact transport capabilities



Ultrasonic Levitation



LASER SECURITY ALARM SYSTEM



What?

- Designed an automated **Laser Security Alarm System** to monitor and secure restricted access zones

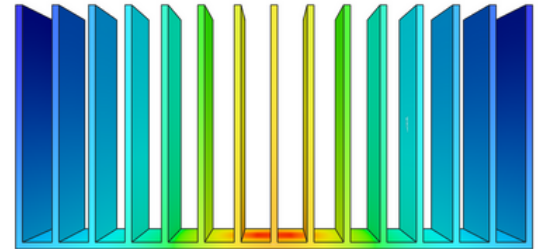
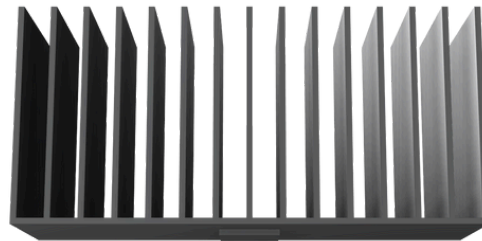
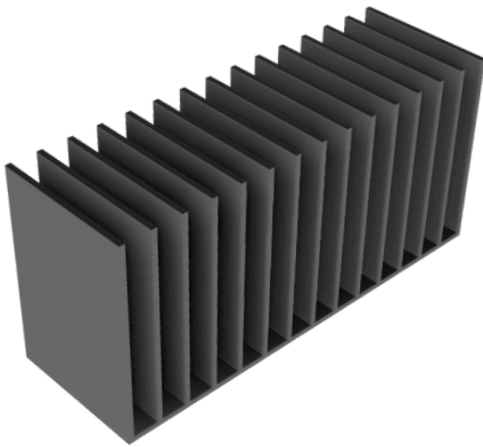
How?

- Developed a continuous detection grid by aligning mirrors and photoresistors to trigger audiovisual alarms immediately upon beam interruption
- Integrated **RFID authentication and the I2C protocol** to manage secure key-card access and real-time LCD status reporting

Results

- Validated system reliability by achieving **instant detection** of physical breaches while enabling seamless bypass for authorized users

HEAT SINK DESIGN



What?

- Designed a heat sink to dissipate heat from a simulated CPU surface, targeting a **$22 \pm 1^\circ\text{C}$** temperature reduction

How?

- Conducted thermal **FEA** to simulate natural convection in Fusion 360 and applied **analytical heat transfer formulas** to optimize fin geometry

Results

- Validated design performance by reducing surface temperature from **85°C to 64.3°C** , achieving a **20.7°C reduction**