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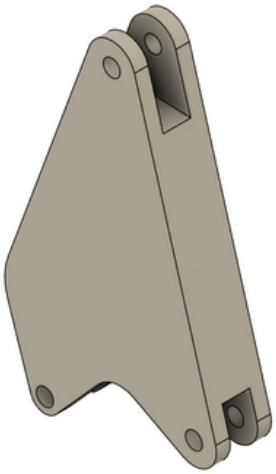
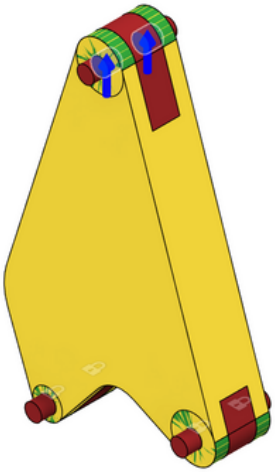
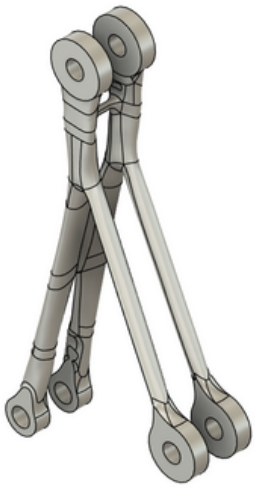
OPTIMIZATION OF AERO-BRACKET FOR LASER POWDER BED FUSION







What?

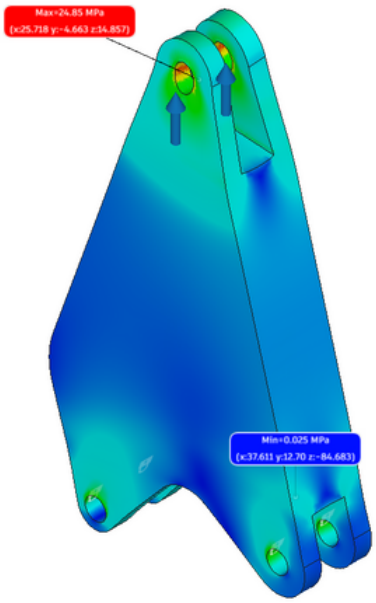
- Optimized an aerospace bracket for **LP-PBF** manufacturing
- Aimed to minimize mass while ensuring safety under a **1600 N** tensile load

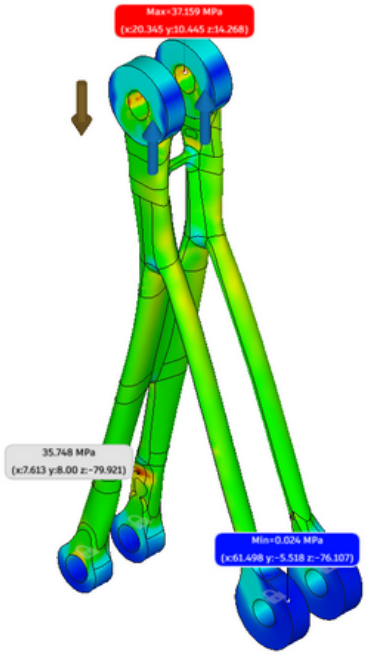
How?

- 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 (223g to 31g) with a **Safety Factor of 6.5**
- Withstood **9018 N** (machine limit) without failure, exceeding requirements by **560%**
- Calculations confirmed peak stress **(~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

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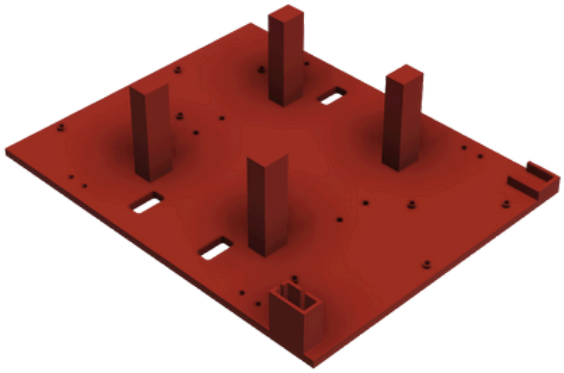
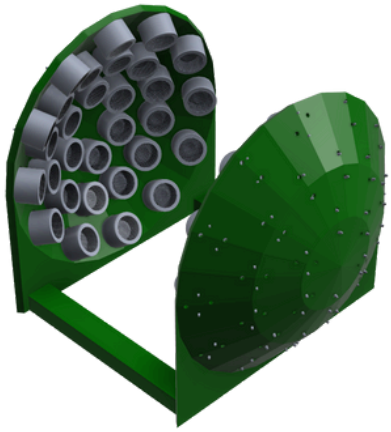
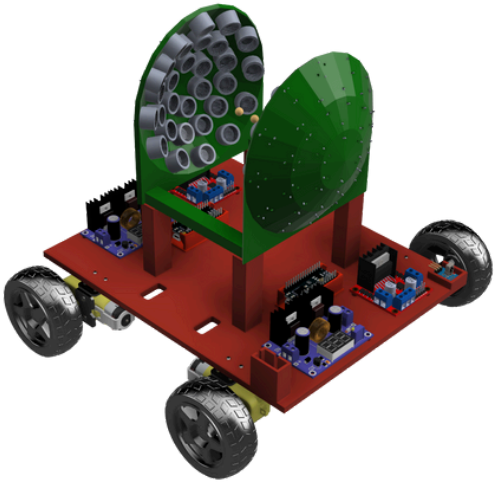
TRANSPORTATION VIA ULTRASONIC LEVITATION SYSTEM







What?

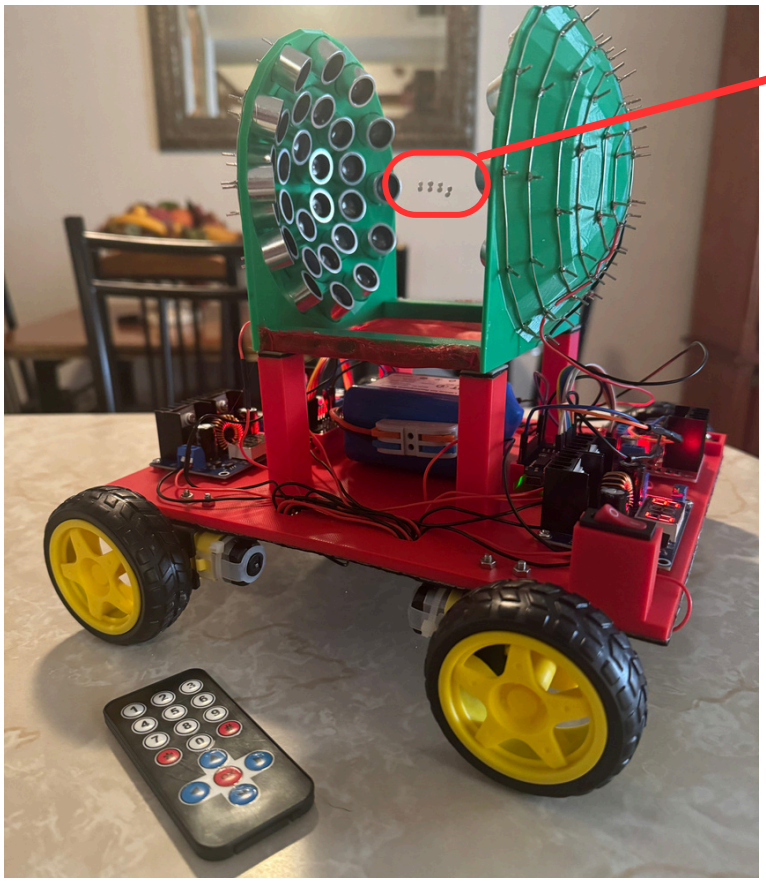
- Created a transport system using **ultrasonic levitation**
- Aimed to **move small particles of styrofoam** without any physical contact
- Focused on demonstrating non-contact object handling

How?

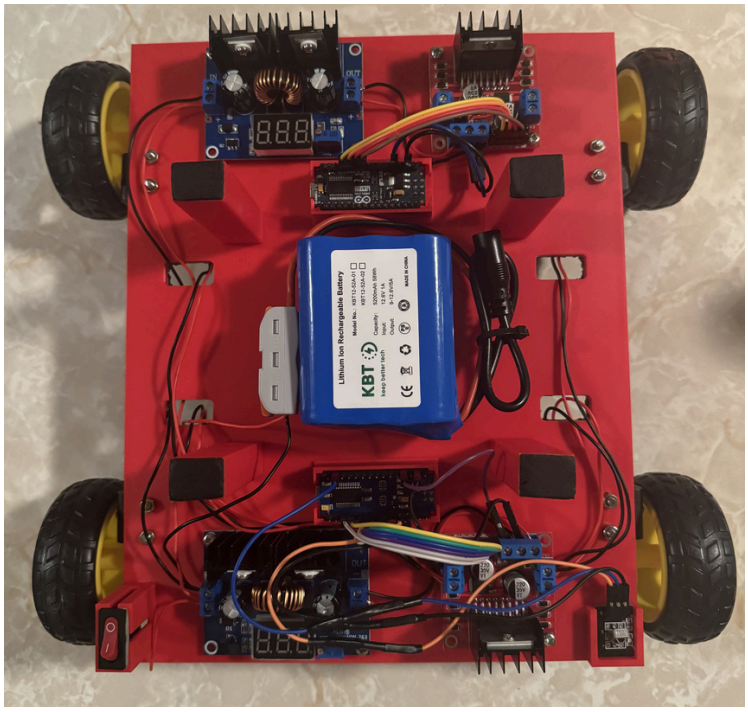
- Utilized Arduino Nanos to control the systems
- Integrated transducers, buck converters, H-bridges, IR sensor and motors for levitation and transportation
- Used **Fusion 360** to design and **3D-print** a custom base for stability and transportation of the systems

Results

- Achieved stable levitation of small particles of styrofoam using ultrasonic waves
- Enabled precise remote control for object movement
- Demonstrated effective non-contact transport capabilities



Ultrasonic Levitation



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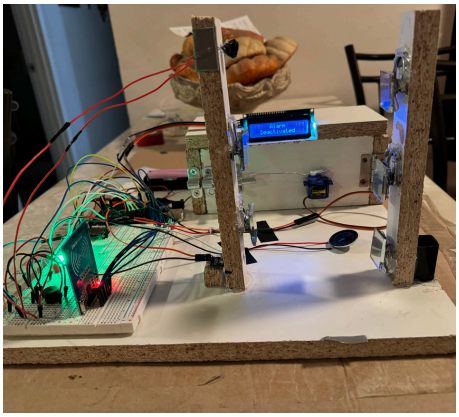
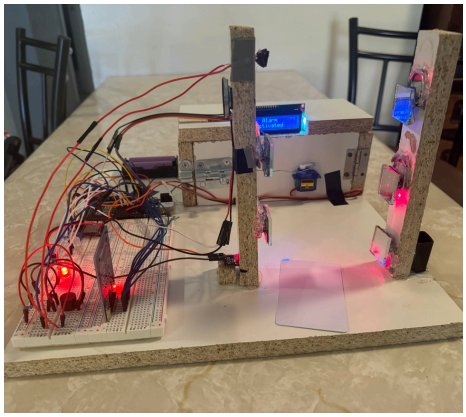
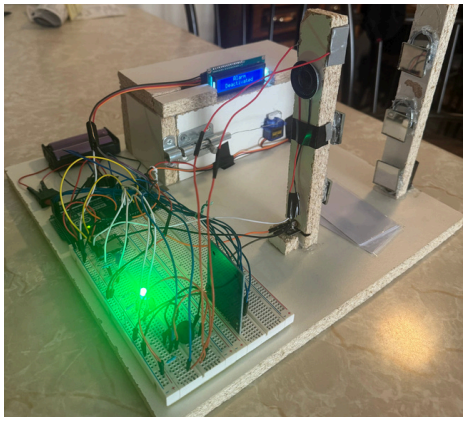
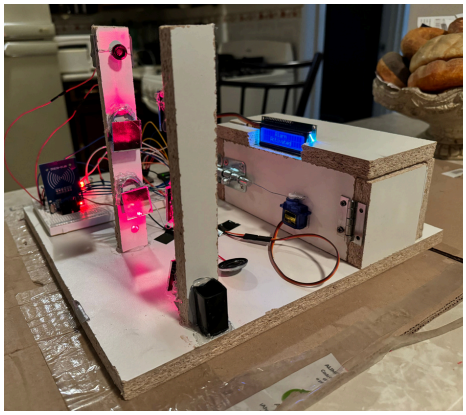
LASER SECURITY ALARM SYSTEM









What?

- Designed a **Laser Security Alarm System** for enhanced vault security.
- Aimed to detect unauthorized access

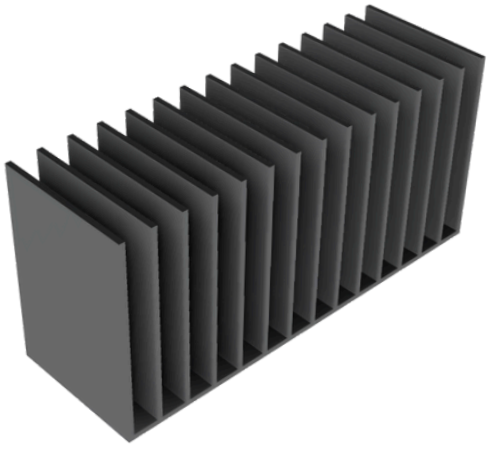
How?

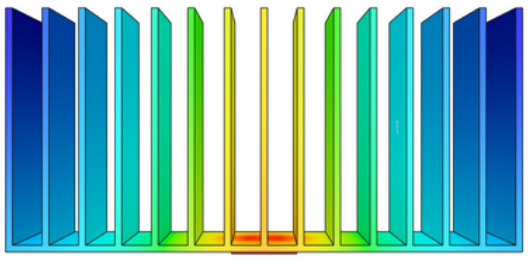
- Integrated a laser with strategically placed mirrors to form a detection grid.
- Utilized mirrors, alarms, laser, servo, photoresistor, LCD display, and **RFID and I2C technology**
- Connected **audiovisual components** to trigger an alarm when the laser beam was interrupted
- Implemented an **RFID sensor** for key card access for authorized entry

Results

- Achieved accurate detection of obstacles breaking the laser grid
- Successfully integrated RFID access control for user convenience
- Delivered a reliable, effective security solution for sensitive areas

HEAT SINK DESIGN





What?

- Design a heat sink that lowers a simulating CPU surface by **22±1°C**
- Performed a natural convection-cooled thermal simulation

How?

- Used **Fusion 360** to design the heat sink and perform the thermal simulations
- Used **heat transfer formulas** to determine characteristics

Results

- The design fulfilled its purpose by reducing the temperature of the surface from **85°C to 64.3°C**