Portable Elastic Light Scattering (ELS) System for Targeted Bacterial Analysis & Recognition

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Team ELSTAR has designed, fabricated, and tested a portable Elastic Light Scattering (ELS) system for rapid, non-destructive bacterial identification. Addressing constraints on cost and portability, the final device features a compact 6.6” x 6.0” x 6.0” footprint and weighs under 20 lbs. The system utilizes an R-θ scanning mechanism, rotating the petri dish while translating the optical mechanism linearly, to locate bacterial colonies in under 1.5 minutes.

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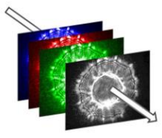
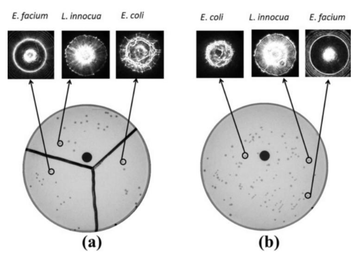


Problem Definition

- Current Issue: Bacterial identification is typically destructive, limiting the ability to re-test samples
- Technology: Elastic Light Scattering (ELS) allows for non-destructive ID by matching unique diffraction patterns
- Current Gap: Lack of portability limits accessibility and the growth of the scatter pattern database



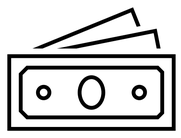
- Project Goal: Design a portable ELS system for rapid, non-destructive bacteria identification, expanding bacterial scatter pattern database

Requirements

Less Than:

12”x6.5”x10.5”

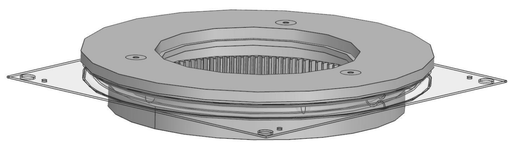
$2,000



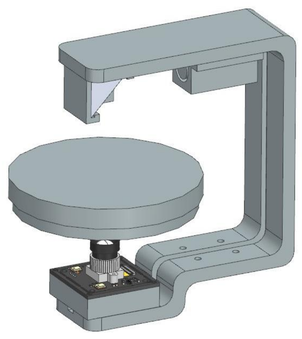
20 lbs

Final Prototype

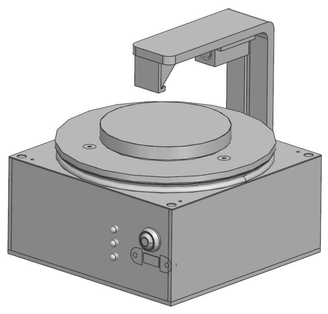
- Mechanical Design
  - Rotational Assembly



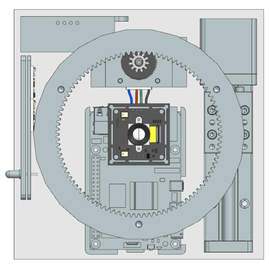
  - Linear Assembly



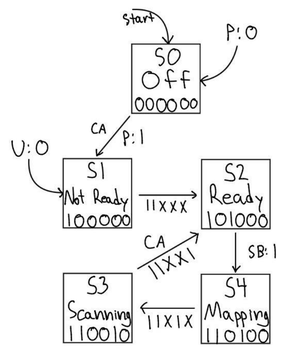
  - Housing



- Electronics & Control System
  - Internal Packaging

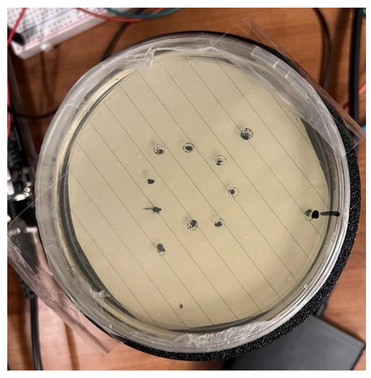


  - Finite State Machine



Testing & Validation

- Tests Completed
  - Agar Viscosity Test: No movement up to 200 rpm



  - Laser Alignment Validation: Laser spot entirely within the camera’s active area

  - Further Testing

Next Steps & Improvements

- Optimize imaging via travelling salesman problem
- Improve gear ratio, motors, and camera FPS for quicker mapping of petri dish

Rapidly identifying bacterial colonies with a compact, portable laser system