

# Pocket Microscope Slide Scanner

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## Sponsor

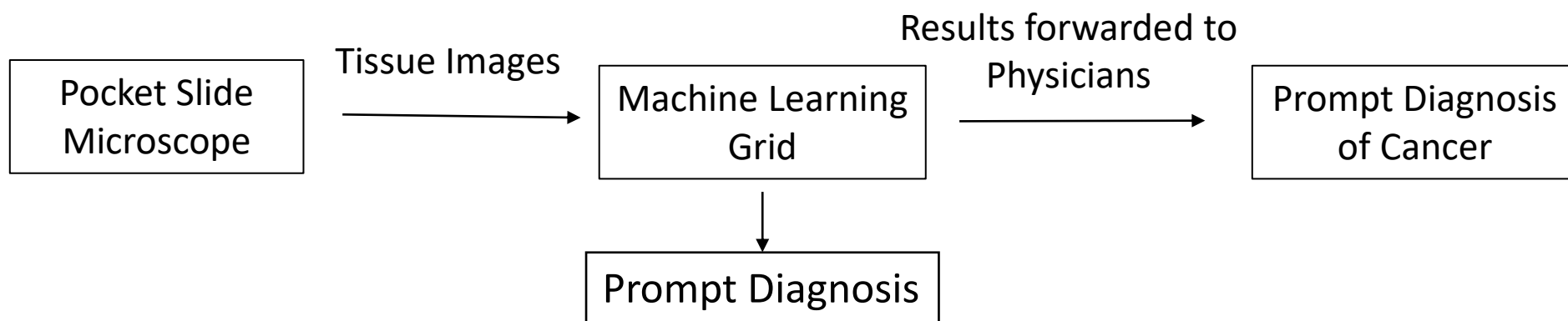
Children's Cancer Therapy  
Development Institute

## Advisor

Dev Shrestha



# Value Proposition



According to the World Health Organization, 70% of deaths caused by cancer worldwide occur in developing countries. Many forms of these cancers are not terminal if caught early enough.

*We aim to create a device that will:*

- Capture an extremely high-resolution image of a sample of tissue
- Stitch 100's of images to achieve desired resolution
- Interface directly with a user's phone

We offer an affordable, highly portable, rugged, and practical solution for early cancer detection.

# Product Requirements

## Cost Requirement

- **Device will cost < \$1000**

## User Interface Requirements

- Minimal buttons
- Interface device via Apollo app support
- Live view of slide
- Coarse and fine adjustments to adjust field

## Storage and Battery Requirements

- MicroSD card support
- Utilization on phone storage
- **150 mm x 80 mm x 30 mm**
- **Minimum of 8000 acquisitions per charge cycle**

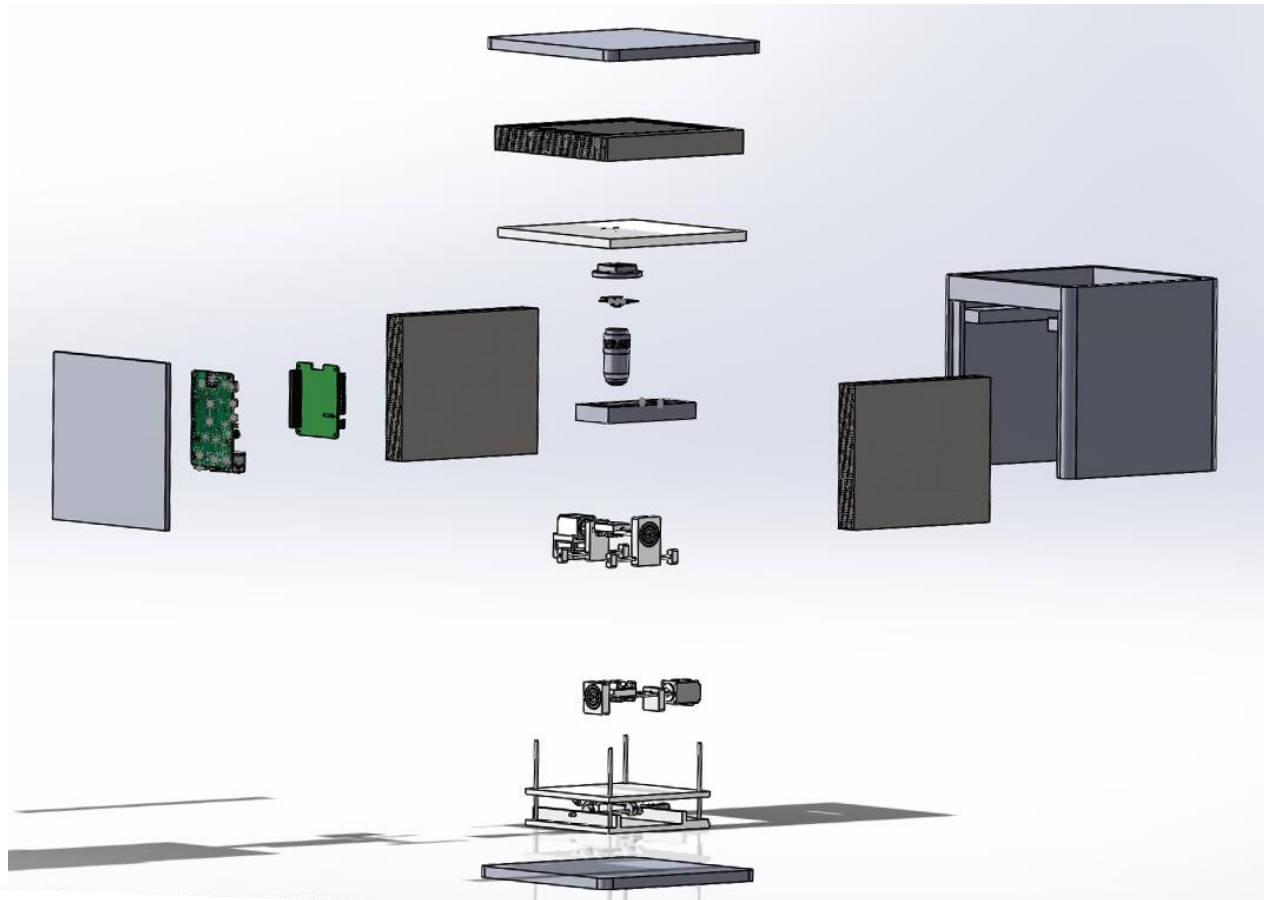
## Optics and Camera Requirements

- **20x effective zoom**
- **0.25 - 0.5  $\mu\text{m}$ /pixel resolution**
- **large format imaging capability (up to 1cm<sup>2</sup>)**
- LED light source (5600K)
- Auto white-balance (optional)
- Auto-focus

## Networking Requirements

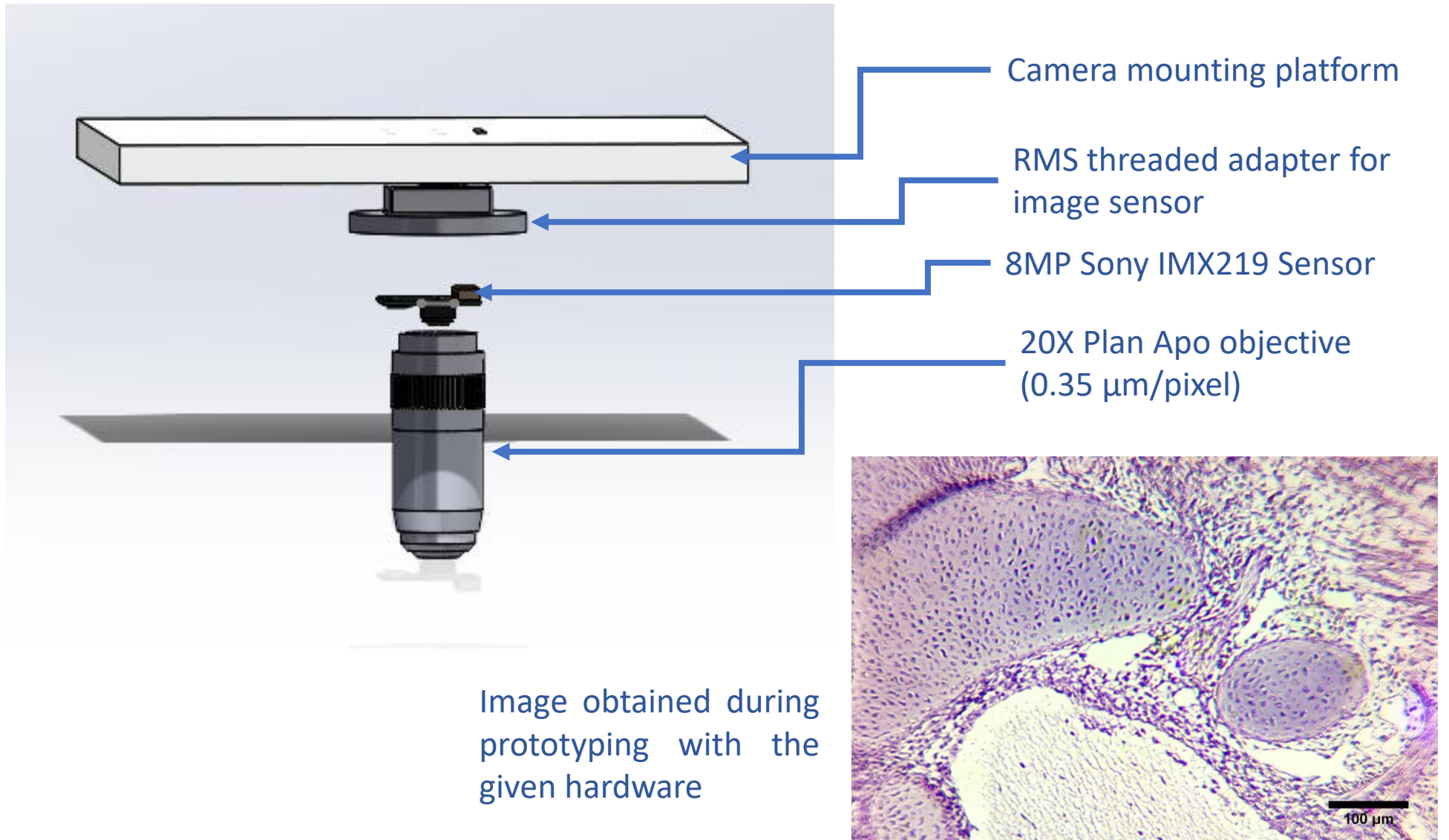
- Wi-Fi (802.11 b/g/n compliant)
- Bluetooth 4.1 compliant
- 4G LTE when paired with smartphone

# Design Concept



- Standalone and optimized device
- Utilizes a Raspberry Pi 4 to process and distribute image to phone
- Optimized stitching algorithm executed on-board RPi 4
- 8MP Sony IMX219 Sensor
- Bluetooth connectivity to phone
- Phone app for device control

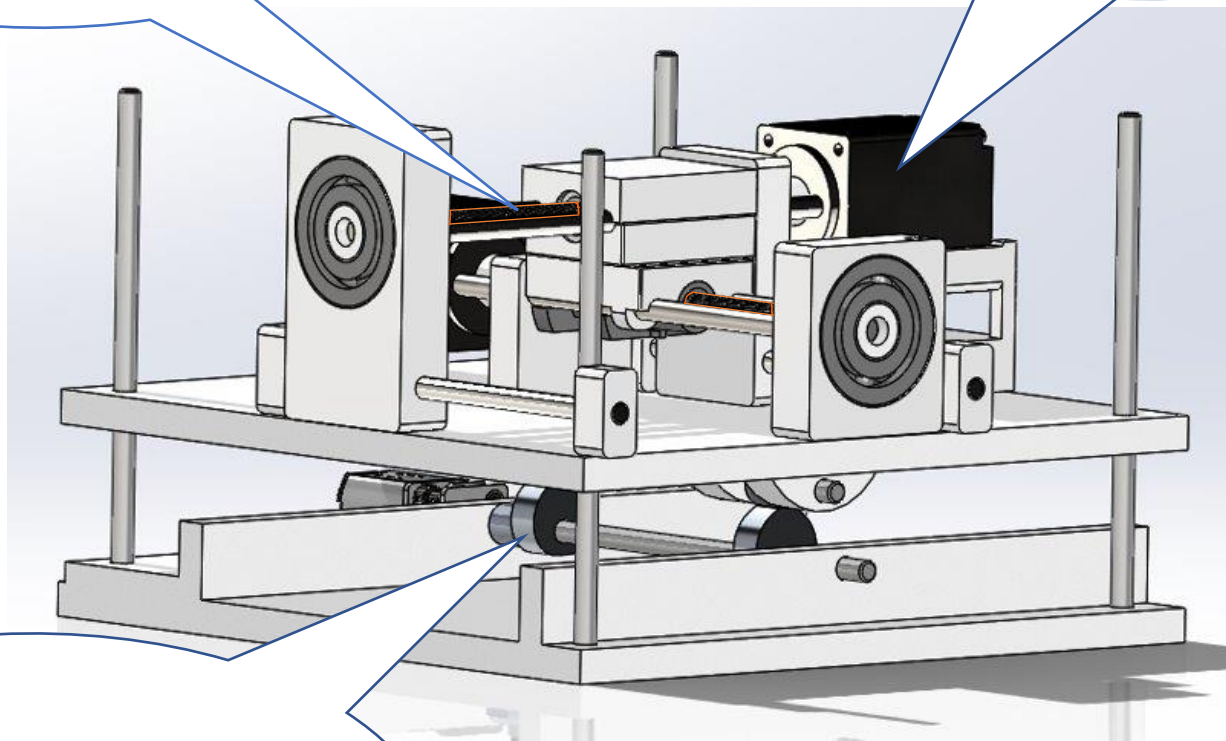
# Optics Design



# Stage Design

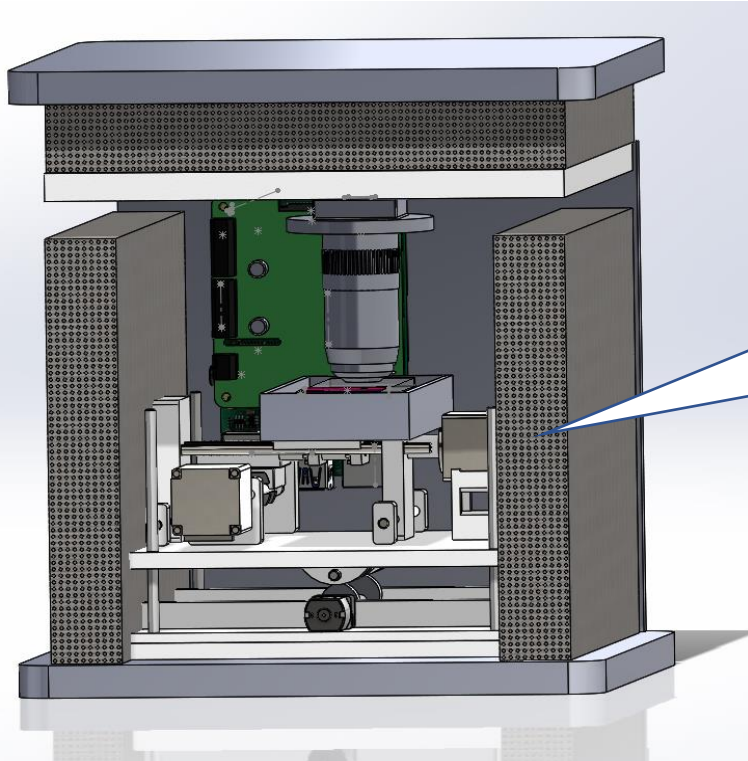
X and Y axis lead screws travel 0.3 mm per turn

Precise stepper motor turns 1.8 degrees per step



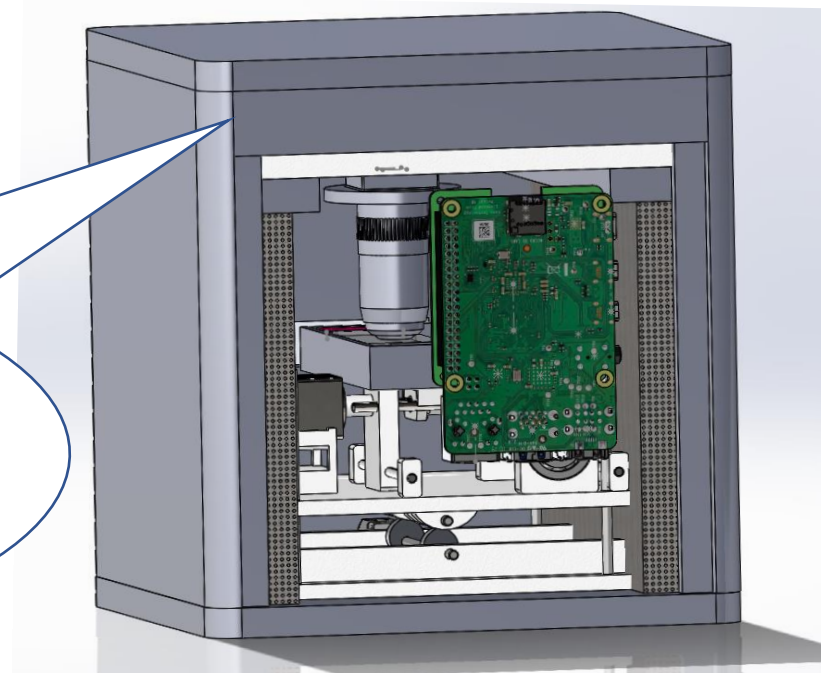
2 small cams are attached to a high torque DC motor to allow stage assembly to translate up to 5mm in the Z direction

# Enclosure Design

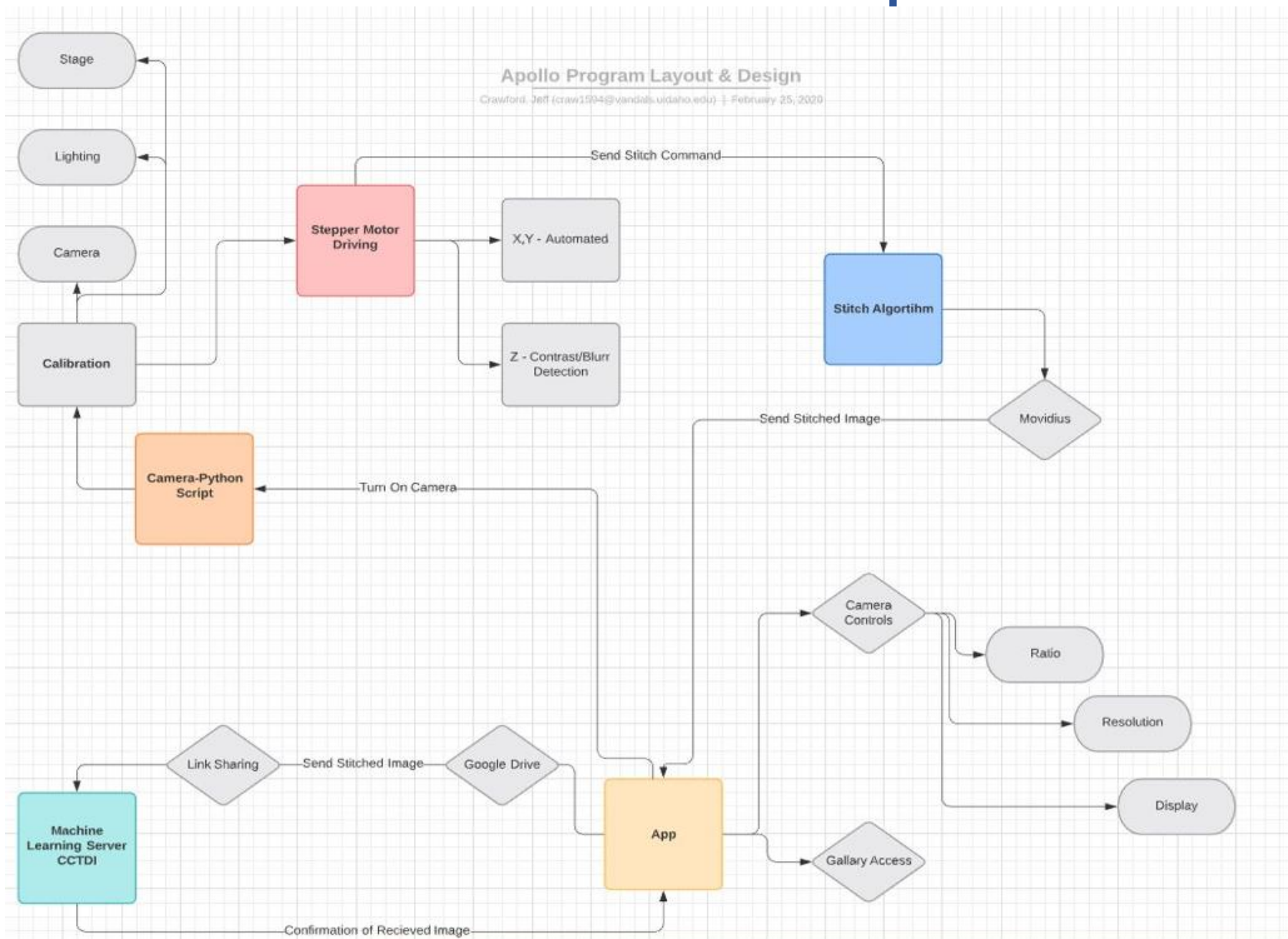


TPU flexible filament printed with 1.0 mm diameter pores for shock absorption, allowing up to ~1.5 cm of displacement

Enclosure is made of ABS plastic composed of 3 pieces, top, bottom, and side walls. The rear piece is an aluminum block that acts as a heat sink for the computer hardware.



# Software Development





# Testing and Validation

Test	System	Metric	Possible Solution
Image Sharpness	Optics	Modulation Transfer Function (MATLAB)	Adjust light source distance/ working distance
Precision of movement	XYZ Stage	Standard deviation	Tune step size and voltage output of motor hat
Shock (1-meter drop)	Shock mesh	System Functionality	Tune pore sizes in mesh to reduce/increase K
Water Resistance (30 second submerge)	Enclosure	Physical observation	Adjust gasket size or placement