

Objective

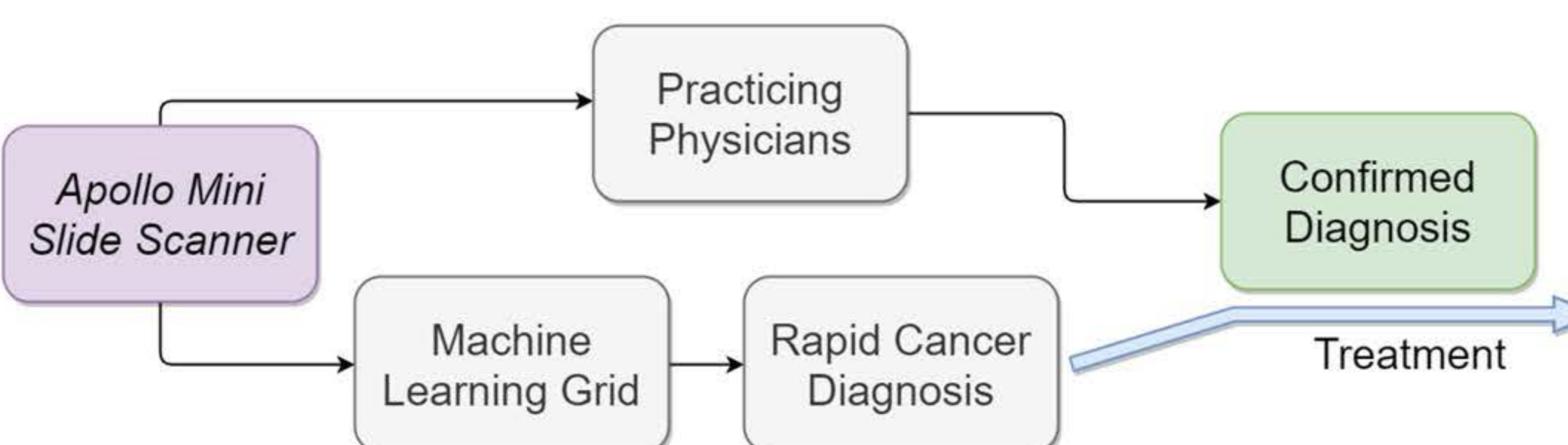
The objective of this product is to provide a highly portable, rugged, and practical solution to diagnosing childhood cancers in developing countries where access to biomedical tools are limited.

We aimed to create a device that would:

- Capture a high-resolution image of a sample of tissue
- Stitch 100's of images to achieve desired image size & resolution
- Interface with a smartphone for image delivery and device control

Value Proposition

According to the World Health Organization, 70% of deaths caused by cancer worldwide occur in developing countries. The overwhelming majority of the diagnosed cases are late-stage terminal cancers. To alleviate this calamity, it is imperative that these countries have accessibility to affordable cancer diagnostic equipment.



Key Requirements

Cost:

- Device under \$1000

Optics and Camera:

- 20x effective zoom
- 0.25 - 0.5 $\mu\text{m}/\text{pixel}$ resolution
- Large format imaging capability (up to 1cm^2)
- Auto-focus

Interface and Networking:

- Interface device via Apollo phone app

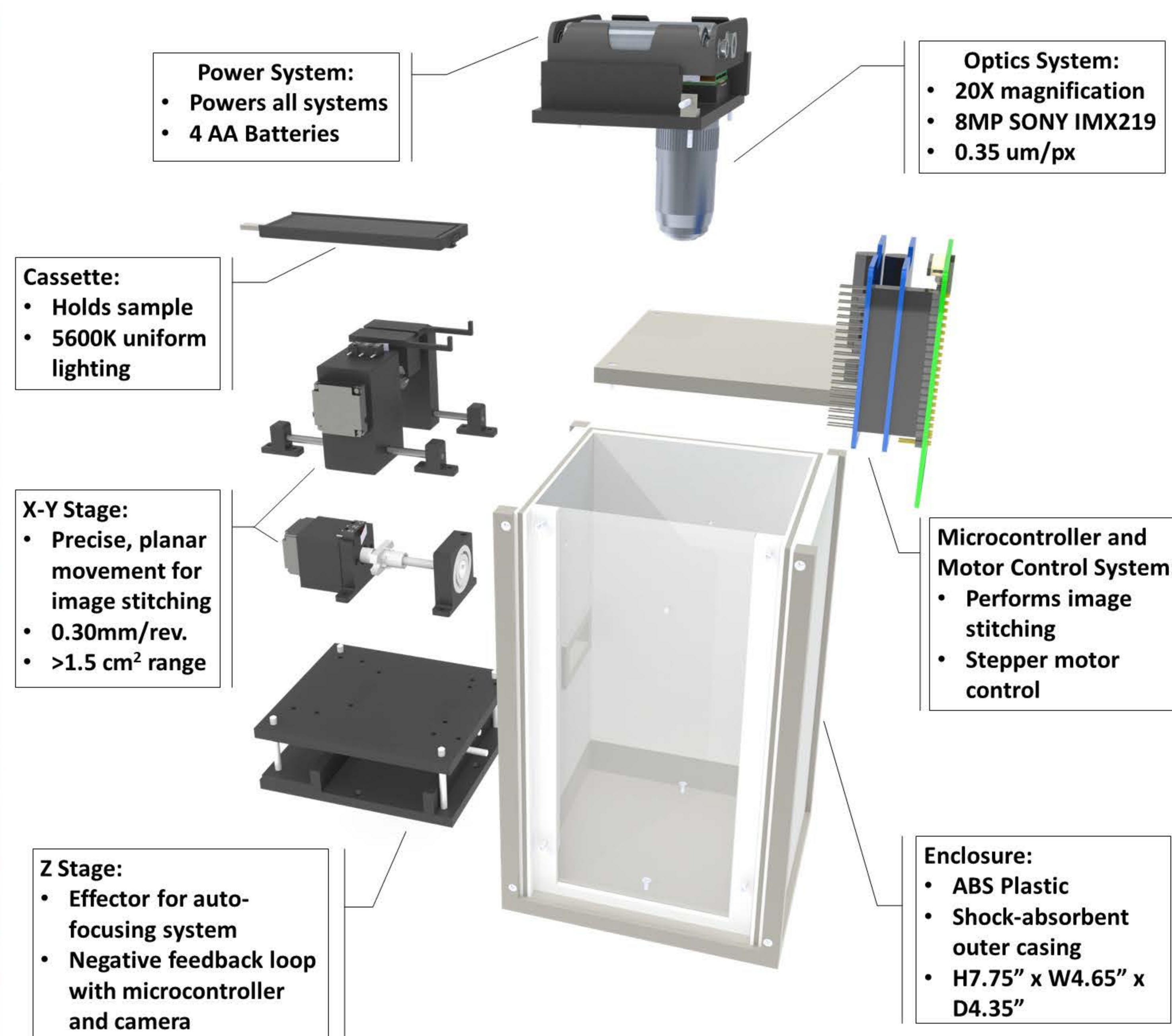
Storage and Battery:

- Utilization of phone memory storage
- 8000 cycles per charge

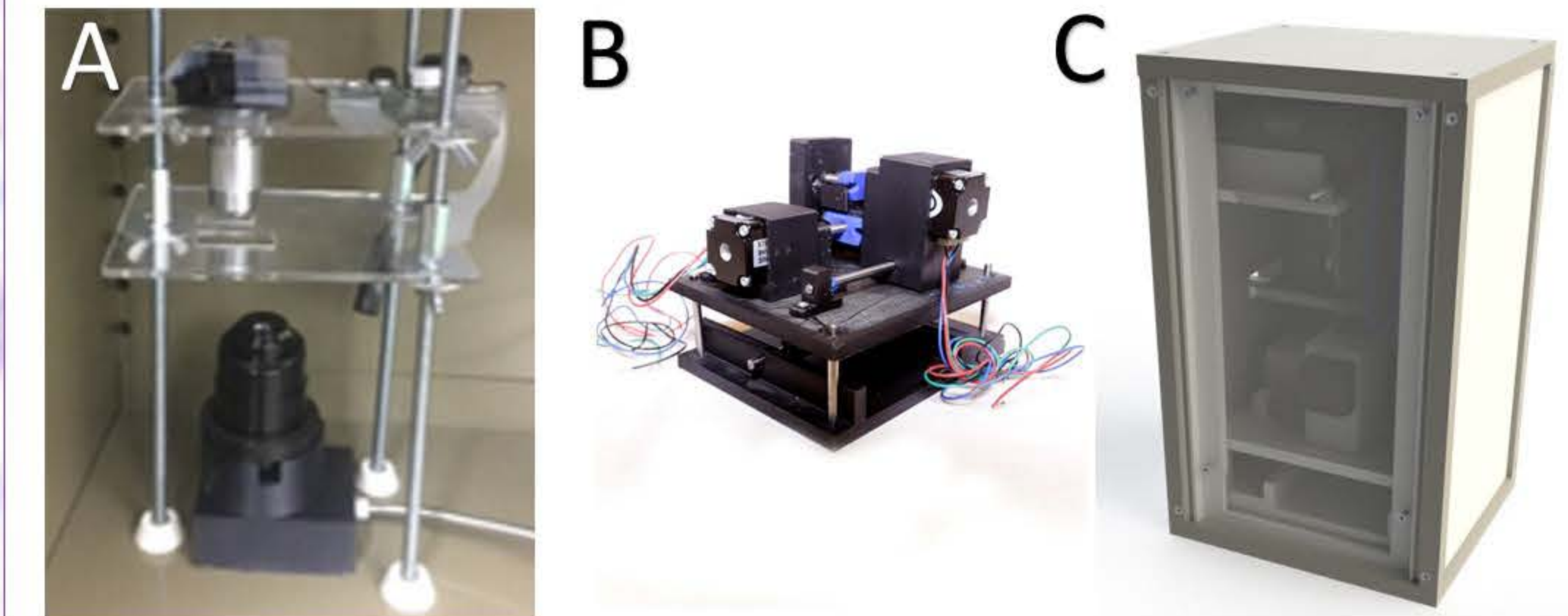


Optics Sub-assembly

Final Design



Concept Development



Design Revisions: Image calibration prototype (A); Initial stage prototype (B); Final Prototype (C).

Validation

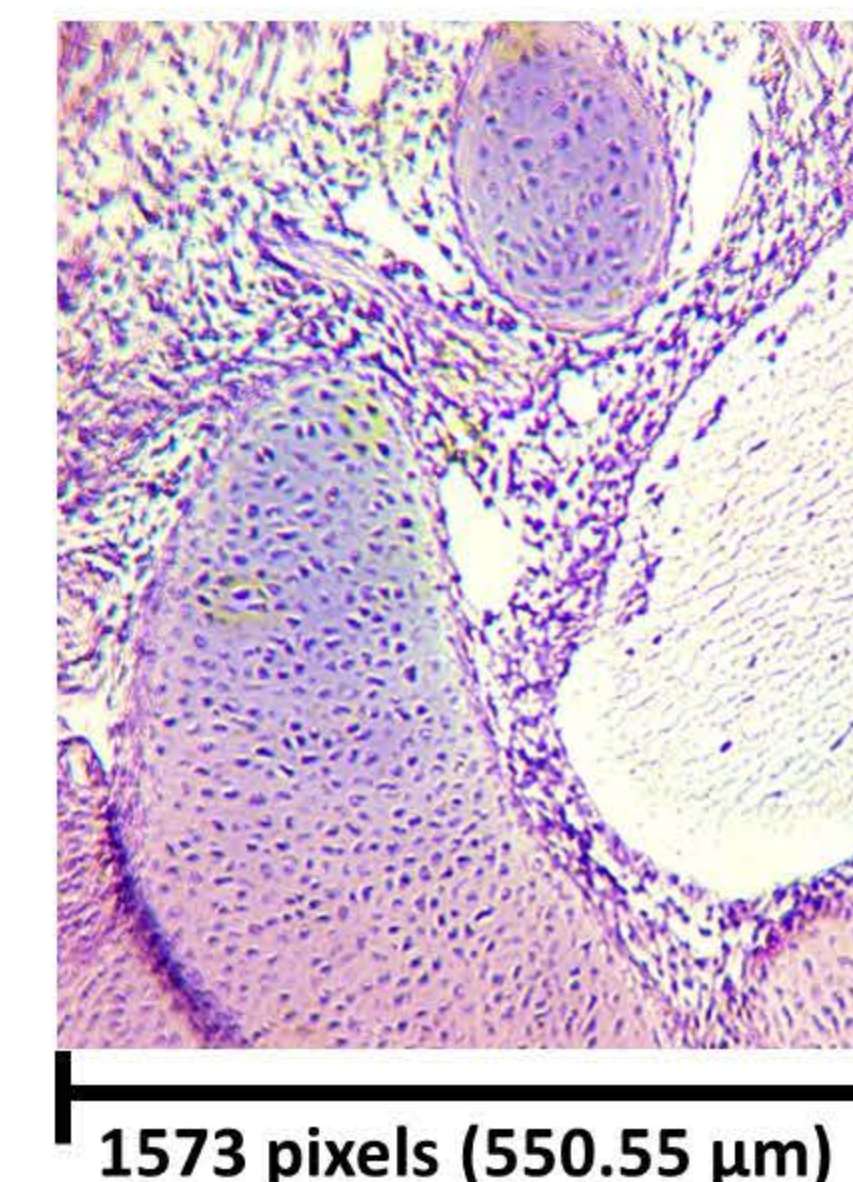


Image Acquisition Time:

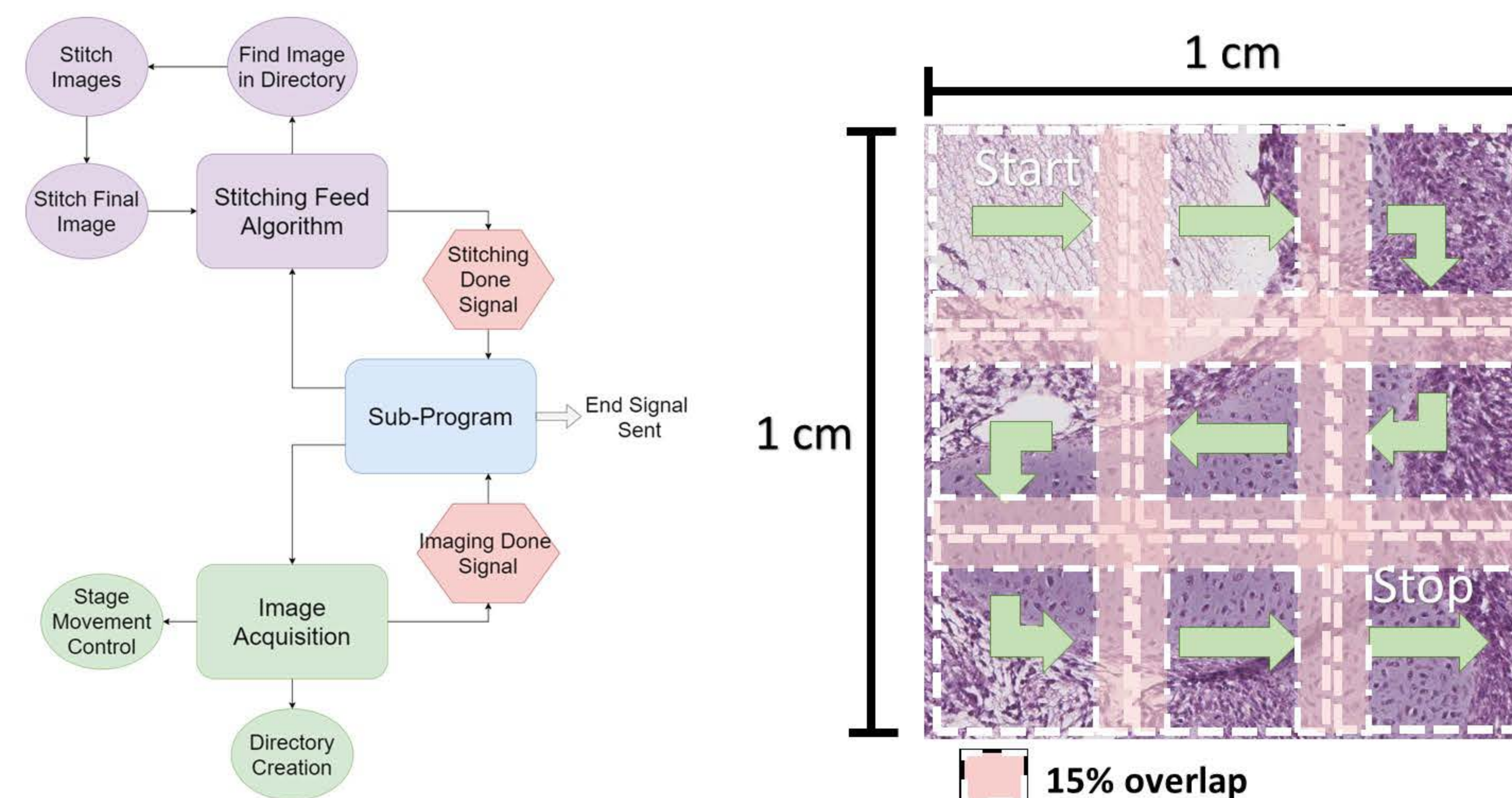
Parameters:	Value:
Lead Screw	300 $\mu\text{m}/\text{rev}$
Motor Speed	10 rev/s
Motor Step Angle	1.8°
Number of Images @ 15% overlap	196

18 minutes required

$$\frac{550.55\mu\text{m}}{1573\text{ pixels}} = 0.35\mu\text{m}/\text{pixel}$$

Effective resolution and 1cm^2 image acquisition time requirement

Software Development



Stitching algorithm process flow chart and image processing path

Conclusions/Recommendations

The prototype, costing \$532 to build includes an imaging system that can accept a standard microscope slide and a moving stage to control the slide positioning via a smartphone app. The smartphone app will signal the device to begin image acquisition and within 30 minutes an image of a 1cm^2 area of the slide will be available for distribution to a machine learning grid and physicians. Future work comprises of further testing on the prototype, including physical stress tests and imaging of confirmed cancerous tissues.

Acknowledgements

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