

- First meeting with Advisor. Meeting time changed to 3:30 pm on Thursday. Archana will update calendar
- Dev approves of the team website.
- Dev wants us to do more literature research and learn more about the optics system before jumping into design.
 - Need to clarify with client whether he prefers standalone device or an extension for phone.

Date: October 1st, 2019

Time: 12:00 pm –12:45 pm

Objectives: Clarify expectation and product requirement with client

Meeting Items:

- First video-conference meeting with Client
 - Dr. Keller, Samuel and Andy were present in the meeting.
- Device Size
 - Preferably the size of a smartphone. No concrete dimensions were given
- Ruggedness
 - Somewhat water resistance
 - Should be dust resistance
 - Team targets to reach IP 67 standard for ruggedness.
- Client is willing to buy smartphone separately for the project. We presented an option for standalone device or smartphone case with extension for magnification. He didn't give any explicit preference but was leaning to a smartphone extension idea.
 - The machine learning website take 20x image. Our team is aiming to get 40 x magnification.
 - Sampling area is 1 cm²
 - Targeted effective resolution is 0.25 micron per pixel
 - Battery life: Should be able to take and process image of 5 slides, USB Charging (MAYBE Qi-Charging Station plugged in USB)
 - Scan time: Maximum 30 minutes for 1 cm²
 - Images for 40x magnification must be stitched together to get final image
 - Client suggested to use live free hand movement and stitch the images together.

Date: October 3rd, 2019

Time: 4:15 pm –5:00 pm

Objectives: Discussion on our first meeting with client.

Meeting Items:

- Use Mirror to reduce working distance of lens and possibly thickness of the device
 - Under consideration but the optics system will be complicated
- Market evaluation
 - What kind of products are in market? How did they achieve the required magnification?
- Client meeting
 - Nico follow up with client regarding questions regarding size constraints

- Client-Send slides to UI
- Product requirement
- Device
 - Size
 - Magnification
 - Ruggedness
 - Cost
 - Acquisition Speed
- Pro and cons of each design
 - Spider chart
- Two different options
 - Standalone
 - Phone case with Nurugo

Date: October 17th, 2019

Time: 4:00 pm – 6:30 pm

Objectives: Review schedule and prepare for second meeting with client.

Meeting Items:

- To do:
 - Michael will bring the scale
 - Jeff will take images with the S9 phone with the scale
 - Archana will email Dev about the Schedule
 - Deadline to finish Portfolio is on Monday, 10/21/19
- Additional Design Ideas
 - External Light-source: Use Condenser to sharpen image?
 - Use an extra lens on top of the nurogo to achieve desired resolution
- SONY IMX586 sensor used in the three phones with 48 Mega pixels
 - Smallest pixel pitch of 0.8 micro sensor
 - Asus Zen Phone 6
 - One Plus 7 Pro
- Second meeting with client on 10/23/2019 at 1:30 pm.
 - Prepared presentation for meeting with client
 - Assigned slides to everyone.
- Started brainstorming for Design validation Plan
 - File saved at Capstone>Apollo>Assignment>Design Validation Plan
- Page Break

Date: October 22nd, 2019

Time: 5:00 pm – 6:45 pm

Objectives: Prepare for video-meeting with client tomorrow

Meeting Items:

- Divided ppt slides to present
- Motor system to hold the slide and create systematic movement

- Curved worm motor
- Planetary gear
- This will help in the saving time while processing image since image will be stitched in an array rather than randomly.
- Discussed difference between Pixel pitch and micron per pixel

Date: October 23rd, 2019

Time: 1:30 pm-2:00 pm

Objectives: Second videoconference meeting with client

Meeting Items:

- Presented both design ideas
- Dr. Keller supported our plan to pursue both design
- Dr. Keller allocated our budget to be around \$5000 for now but can be increased later.
- Samuel will mail histology sample slides to Jeff's home address.
- Team will to visit the Children Cancer Therapy Development Institute on November 25th, 2019.

Date: October 24th, 2019

Time: 4:15 pm-6:00 pm

Objectives: Update on design idea and image stitching

Meeting Items:

- Injection Modelling for Enclosure
 - What kind of material should we pick?
 - Gear (Planetary gear) and rack and pin motions. Backlash?? Curved Worm Gear will have less backlash.
 - Planned to spend time on building enclosure next semester since prototyping is priority for this semester.
- Program will never have to stitch 2 picture at one time.
 - Overlap Percentage- 20%
- Review parts to order for prototyping.
 - Dev will be out of town. Orders from amazon will be shipped to JML. Follow up with Chad regarding parts.
- 3D scanner available on campus in art and architecture building and ME department.
 - Follow up at both places about resolution of scanner and availability
- Request Client to use Zoom instead of google hangout for video-conference.

Page Break

Date: October 29th, 2019

Time: 4:00 pm – 5:30 pm

Objectives: Making Grant Chart to divide work among team members.

Meeting Items:

- Used excel's Template for Grant Chart which is the OneDrive folder
 - File path: Capstone>Apollo>Agenda>Aglie Chart

- Art and Architecture 3D scanner has lower resolution. Plan to email Dr. Odom in ME department about using his 3D scanner to scan parts for our project.

Date: October 31st, 2019

Time: 4:00 pm – 6:30 pm

Objectives: Take pictures with Nurugo and ASUS phone

Meeting Items:

- Dr. Odom gave permission to use his 3D scanners under Selso's supervision.
 - Will set up an appointment with Selso for next week.
- Parts received: Raspberry Pi 4, Pi Zero Starter kit, Nurugo Micro, ASUS ZenFone 6
- Used Nurugo on the ASUS Zen phone.
 - Trouble align the light source from the phone to the nurugo light filter.

Date: November 5th, 2019

Time: 3:30 pm – 6:00 pm

Objectives: Learn to use 3D scanner

Meeting Items:

- Met with Selso, graduate mentor, at ME shop. Instruction to use 3D scanner is give in this link: http://mindworks.shoutwiki.com/wiki/3D_Scanner
 - Could not scan Zen phone and nurugo because of its reflective surface.
 - Took images with zen phone. Since zen phone has two cameras the nurugo fits better with the 12 MP camera.
 - Took basic measurement of the nurugo using caliper from ME shop.
 - Found an open source 3D file of Zen phone. However, it is hard changing this graphic model to 3D solid model.
 - Michael will 3D lens parts this Thursday.
 - Trouble setting up the Raspberry Pi Zero because of high temperature even after using heat sync.
 - Raspberry Pi4 doesn't have a charger. Using Isaacs's charger for now. Need to order some accessories for Ras. Pi.
- Parts received: 40x Lens, Acrylic Stage, and USB Light, 40 x Nikon Achromatic Objective, achromatic condenser, and calibration slide.

Date: November 7th, 2019

Time: 4:15 pm – 6:30 pm

Objectives: Finalize time and place regarding Design review

Meeting Items:

- Updated Dr. Shrestha regarding the 3D printer and Ras. Pi situation.
- Placed order for Pi camera, PLA filament
 - Need to provide filament for ME 3D printers.
- JML has 3D printer that we can use.
- Design Review
 - At BE conference room
 - On Wednesday 20th at 1:30 pm
 - Nico will email client to finalize the date and time.

- The resolution of image using Zen phone is about 0.55 microns per pixel.
 - To reach target resolution, we will use a 2x magnification class.
 - Image was sharper when LED light was used below the object.
- Installed ImageScope in Archana's laptop
 - Use that software to see the image of slide that was taken by client's microscope.
 - The resolution of that image was 0.249 microns per pixel at 40x.
 - Received slide sent by client.

Date: November 12th, 2019

Time: 4:00 pm – 6:30 pm

Objectives: Start Prototyping

Meeting Items:

- Received permission from Dr. Peng to use EP 403 to store our project parts.
- Parts Received: Pi Cam
- Made draft 3D model of the neurogo.
- Made the structure for prototype.
- Ran a test to take picture using pi camera. The picture came blurry because we didn't have the stage setup yet.

Date: November 14th, 2019

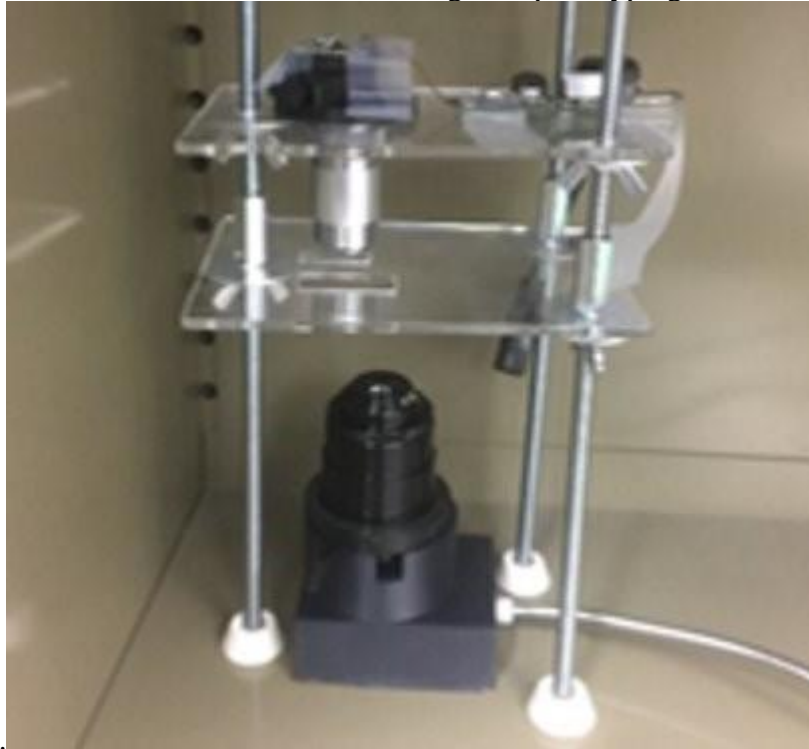
Time: 5:00 pm – 6:30 pm

Objectives: Taking pictures from standalone device

Meeting Items:

- Reserved BE conference room for design review
- Took an image from the standalone prototype

- Brought screws and washer to build the stage for prototyping as shown in



the image alongside.

- The image was “too magnified” because very slight movement of the slide would cause drastic change under the microscope.
- Image resolution was about 0.11 microns per pixel.
- Ras Pi was heating up significantly.
- Took pictures from nurugo
 - Profound Vignette effect
 - The resolution was not met.
 - Looked up magnification lens (2x or more) to place on top of the nurugo in order to meet the resolution.

Date: November 19th, 2019

Time: 5:00 pm – 6:30 pm

Objectives: Preparing for Design review

Meeting Items:

- Divided work for design review.
- Everyone was assigned to specific sections to work on the presentation.
- Nico 3D printed a new stage to have stability for base (four legs instead of 3) and bigger light aperture for the slide.
- Archana 3D printed the threaded base for lens. However, the threading did not work
- Jeff worked on the emulator and developed a preliminary version of near-live code.
- Ordered magnification lens design B.

Date: November 20th, 2019

Time: 1:30 pm- 2:15 pm

Objectives: Design review

Meeting Items:

- Zoom worked better than google hangouts for video conferencing.
- Design review was focused on updating client and giving some background information to attendees.
- Client appreciated our effort and progresses.

Date: November 21st, 2019

Time: 4:15 –5:00 pm

Objectives: Preparation for trip to client's lab

Meeting Items:

- Michael, Archana and Nico are going to Portland to visit Client's lab.
- Team members submitted risk and liability form to Dr. Shrestha.
- Booked hotel for 11/24/2019.
- Reserved CNR Ford explorer
- Divided Financial responsibilities
 - Archana = Food
 - Michael = Hotel
 - Nico = Gas

Date: December 3rd, 2019

Time: 5:00- 6:00 pm

Objectives: Preparation for Snapshot

Meeting Items:

- Nurugo-intergrated design
 - Working distance using 2x lens on top of nurugo was extremely large
 - Resolution was not met, and the image was not sharp.
 - Team will likely eliminate this design ideas after discussing with our advisor.
- Drew a pre-CAD drawing of the enclosure.
 - Nico and Archana will finish the CAD drawing by 12/5/2019 and Michael will 3D print it.
- Standalone design
 - Team decided to use 20x microscope instead of 40x because of extremely high resolution in 40x as well as complication with slide movements.
 - Resolution of about 0.35 micros per pixel was achieved.
 - Sharp images however, there was a purplish tint caused by the light source.
 - Plan to by a smaller diffuser/condenser and better-quality light source.

Date: December 5th, 2019

Time: 4:15 –6:00 pm

Objectives: Preparation for Snapshot 2- Part 2

Meeting Items:

- Issacs working on using VPN or Ras Pi app for live demonstration of standalone device.
- The enclosure drawing finished.
- Divided presentation Slides to work among Team members.
 - Issacs tasked to print the presentation slides for snapshot.
- CS Team developed goals for next semester
 - - Use Python Console to call Python Image Stitching -- Be able to stitch up to 16 images , feed in manually already stored in a dir. - Interface the App like VNC with the Pi-0/4 - Stage Control / Sensor -- Be able to stitch up to 1600 images , feed in dynamically & utilize linear stitching - Overlays and App layout - Beautify (Wrap up)

Date: January 18th, 2020

Time: 10:00 am- 12:30 pm

Objectives: Brainstorm Stage Concept Design

Meeting Items:

- This meeting was between the Design Team
- The X and Y axis will be a lead screw and stepper motor combination
- The Z stage will compose of two Nautilus gear and guide rails. This design was chosen to decrease the size of stage.
- Motor HAT for raspberry pi will be used to connect the motors to pi.

	Task	Deadline
Michael	Research potential Light Sources	1/23/2020
Archana	Make Carriage and components for X and Y axis, start the purchase list	1/23/2020
Nico	Find the ball bearing and build the parts required for Z axis.	1/23/2020

Date: January 23rd, 2020

Time: 4:15 pm- 5:30 pm

Objectives: Establish Milestone and share progress

Meeting Items:

- CS Team
 - Dev suggested to use image contrast as a control factor to adjust focus (Using the Z stage).
 - Suspects that the processing power will not be enough for stitching.
 - Dev will give Intel Core stick to CS Team.
- Design Team
 - Presented Concept Design with rest of the team. Dev encouraged them to research more on Z stage movement.
 - Make an animation video of the stage assembly by next week.
 - Email the Part 3 purchase list by Friday.

Date: February 27th, 2020

Time: 3:30 pm -4:30 pm

Objectives: Preparation for Engineering Design Review

Meeting Items:

- BE conference room is booked for design review. Email was sent to Dr. Swenson regarding the date and time of the review.
- Reminder email will be sent to the client about the review.
- There should be CAD models for stage assembly along with an animation video. Along with that, concept models for enclosure, shock mesh and optics system should be included.
- Flow charts will be used to explain the software design.

Date: March 5, 2020

Time: 3:30 pm – 4:00 pm

Objectives: Reflection of client's email and design pursuits

Meeting Items:

- Dev's expectations
 - Have at least one image captured with our current design and analyze image quality
 - Pursue current design idea because it is too late to change concept design
 - Client can decide whether he wants to keep this product or focus on other designs next year
- Machining parts
 - Material (ULEM) suggested by Dr. Swenson is expensive and needs special 3D printer. Selso suggested we use either aluminum or ABS for the prototype.
- Design Team
 - Accommodate the size of enclosure for motor switches in X and Y axis
 - Divide individual tasks (enclosure, stage, electrical, mesh system) on Thursday between the design team members.
 - Meanwhile, focus on CAD modelling and assembling X and Y stage.
- CS Team
 - Work on the coding the stepper motor. The Y axis stage is assembled and present in the BE lounge.
 - *Missed some discussion points between Dev and Isaac (Archana)