The Knotorious Five

March 20 - March 26

Client: Dr. Margene Anderson, Dr. Sara Colopy. Dr. Paul Merkatoris
Advisor: Professor Wally Block

Team Members:
Madison Michels (mmichels2@wisc.edu), Leader
Lucy Hockerman (lhockerman@wisc.edu), Communicator
Presley Hansen (pmhansen3@wisc.edu), BWIG
Sadie Rowe (skrowe2@wisc.edu), BPAG
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Problem Statement:

In veterinary training, mastering the skill of applying appropriate suture tension is essential for successful wound closure and patient recovery, However, novice practitioners often struggle to judge the correct amount of force needed, leading to either insufficient tension or excessive tension, which can cause plastic deformation of the suture material or tissue damage. Currently, the evaluation of suture technique relies heavily upon subjective instructor feedback, lacking objective, real-time metrics to guide learners. This gap hinders consistent skill development and increases the risk of procedural errors. There is a critical need for a real-time suture tension measurement and feedback system to help students learn to apply optimal tension, prevent material or tissue compromise, and improve surgical outcomes through data-driven training.

Brief Status Update:

This week, the team took new images to train another ML model. We used the Pi camera and camera stand for consistent images and angles. We cropped these images to 500x500 resolution and converted them into fully black and white images. This removes the background noise and allows the model to easier identify the gaps in the knots. We began training the new model on these images.

Team Goals:

Next week, the team hopes to finish the workflow on the pi by implementing the LED system and new model.

Individual Accomplishments:

- Lucy: This week, I helped the team take new photos of sutures. I also updated my notebook to include documentation of our fabrication process for future reference.

- Presley: This week, I worked with the team to get new photos of the sutures with the HQ camera. We worked on cropping images and beginning retraining of a new model.
- Maddie: This week, I helped take pictures of the new sutures and save them onto the Pi disk. I also wrote code to center crop the images to 500x500 pixels and remove the background of the images. This code also created binary images (0, 255). Lastly, I retrained a model on these images.
- Sadie: This week, I took pictures of the remaining features on the Pi HQ Camera. I helped Maddie sort through the binary images. Many of the knots were not cropped to the center of the image, so I manually centered each knot without cropping so Maddie could re-crop and process the images to improve the dataset.
- Kate: This week, I worked with the team to take new pictures of the suture knots we tied last week. These pictures are more consistent and higher-quality images. These pictures will build a new dataset to train a new model.

Individual Struggles:

- Lucy: None.
- Presley: None.
- Maddie: None.
- Sadie: None.
- Kate: None.

Individual Goals:

- Lucy: Next week, I would like to conduct testing with the full system workflow and begin preparing our final deliverables and research paper.
- Presley: Next week, I would like to get the full system workflow solidified.
- Maddie: Next week, I would like to begin testing the full workflow of the system.
- Sadie: Following spring break, I would like to get the LEDs working alongside the new model and determine a better mechanism to move the camera over a skin pad
- Kate: Next week, I want to get the LEDs and button integrated into the Pi system. I would also like to start working on the final deliverables.

Project Timeline:

Week	Description	Date	Status
1/22 - 1/29 Week 1	Team Meeting 1	1/26	Completed
	Advisor Meeting 1	1/23	Canceled
1/30 - 2/5 Week 1	Team Meeting 2	2/4	Completed

	Advisor Meeting 2	1/30	Completed
2/6 - 2/12 Week 3	Preliminary Presentations	2/6	Completed
	Team Meeting 3	2/9	Completed
	Advisor Meeting 3	2/13	Completed
	Order Raspberry Pi Camera and Board	2/13	Completed
2/13 - 2/19 Week 4	Images Augmented	2/16	Completed
	K-Fold Cross Validation	2/18	Completed
	Receive Materials	2/18	Completed
	Model Trained	2/20	Completed
	Team Meeting 4	2/18	Completed
	Advisor Meeting 4	2/20	Completed
2/20 - 2/26 Week 5	Preliminary Deliverables	2/25	Completed
	Upload Model onto Pi	2/20	Done
	Team Meeting 5	2/23	Completed
	Advisor Meeting 5	2/27	Complete
2/27 - 3/6 Week 6	Submit Patent to WARF or IDR	3/6	Undecided
	Team Meeting 6	3/4	Complete
	Advisor Meeting 6	3/6	Complete
3/7 - 3/12 Week 7	Team Meeting 7	3/13	Complete
	Advisor Meeting 7	3/13	Complete
	Get the Pi camera running	3/8	Complete

3/13 - 3/19 Week 8	Team Meeting 8	3/18	Complete
	Advisor Meeting 9	3/13	Complete
	Implement Pi camera and images into user system	3/13	Complete
3/20 - 3/26 Week 9	**Show and Tell**	**3/20**	Complete
3/27 - 4/2 Week 10	Select Design Award	4/1	Not Started
	Executive Summary (Draft)	4/1	Not Started
4/2 - 4/8 Week 11			
4/9 - 4/15 Week 13			
4/16 - 4/22 Week 14	**Executive Summary**	4/17	Not Started
4/23 - 4/29 Week 15	Final Pressentations	4/24	Not Started
4/30 - 5/5 Week 16			
Winter Break			

Expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	QTY	Cost Each	Total	Link

Force Sensor Resistor	Force sensor that outputs resistance in a voltage divider circuit (2 in pack)	Haosie	N/A	Amazon Prime	N/A	10/1	1	$7.59	$7.59	Link
Raspberry Pi Kit	Contains: Raspberry Pi 5 8GB, 27W power supply, active cooler, 64 GB SD card, card reader, 4K Mico HD out cables, and case	Vemico	B0D2WYFS23			2/8/2026	1	$173.99	$173.99	Link
Arducam IMX477 Pi HQ Camera	HQ Camera + CS 6mm lens	Arducam	B024002			2/8/2026	1	$67.99	$67.99	Link
									TOTAL: $249.57	