The Knotorious Five

April 10 - April 16

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
Kate Hiller (khiller@wisc.edu), BSAC

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 completed the executive summary. We also completed coding, assembling, and testing the pi module with different models.

Team Goals:

Next week, the team plans to complete the final presentation and present to academia.

Individual Accomplishments:

- Lucy: This week, I worked with the team to run full model latency testing. I created a spreadsheet to document data collection. The final results of testing are listed below:

	Tight	Loose
Mean	3.9377	3.9292
StD	0.0238376453	0.03483548638
Range	3.983 - 3.901	3.972 - 3.857

- Presley: This week, the team and I got the whole raspberry pi workflow running (including the button and LEDs). We completed latency testing, which had an average time of about 3.9 seconds (this was successfully below our target value of 5 seconds).
- Maddie: This week, I trained 3 models using filtered images from the binary, original, and contrasted datasets. I determined that with greater feature omission, the loose knots perform better because the holes in the center are more self-explanatory. On the contrary, the feature omission decreases the model's performance on the tight knots, suggesting that the model relies on depth perception and colored features to evaluate tight knots. I also tested these three models and our first one (from last semester) on 224 images each. These images were consistent across all of the models. Moving forward, the team plans to use the model trained on unedited (normal) images, as it has the highest accuracy of the models. Lastly, I also wrote code for and ran latency testing to evaluate the full workflow's timeliness (average of about 3.93 seconds).
- Sadie: This week, I worked with the team to get the full Raspberry Pi workflow functioning. We edited the workflow code to correct errors and added a preview with center marking to help center the knot prior to capturing and cropping the image. The workflow now proceeds as follows: a button press initiates a preview, a second press captures the image and runs it through the model, and the classification result is displayed via an LED. This completed workflow was used for latency testing, with a total runtime average of about 3.9 seconds.
- Kate: This week, I worked with the team to get the entire Raspberry Pi workflow working with the button and LEDs. We were able to get the entire workflow working, including having a centering dot for the user to center the knot in front of the camera for the model input image. We also completed hardware validation testing and workflow latency testing.

Individual Struggles:

- Lucy: No struggles this week.
- Presley: I am struggling to pick which of the trained models to pick for the final poster presentation.
- Maddie: I am struggling to determine which model is the most comprehensive for our needs, as they all perform differently in different classifications.
- Sadie: I am having a hard time deciding how to present our models since each one achieved low accuracy, with some performing better at classifying tight knots and worse at loose knots or vice versa.
- Kate: No struggles this week.

Individual Goals:

- Lucy: Next week, I will prepare and present our final poster for faculty, clients, peers, and judges.

- Presley: The main goal remaining is to prepare final deliverables and present the final poster next Friday.
- Maddie: I plan to complete the final presentation poster and present to our faculty and peers.
- Sadie: Next week, I will create the poster presentation, present our work, and begin the final report. I also plan to organize out testing methods and code better to facilitate future work on the project.
- Kate: I plan to work on the poster and 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	TBD
	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
	Advisor Meeting 10	3/25	Complete
3/27 - 4/9 Week 10	Select Design Award	4/1	Complete
	Executive Summary (Draft)	4/1	Complete
	Advisor Meeting 11	4/8	Complete
4/10 - 4/16 Week 13	Complete project assembly	4/16	Complete
	Complete project testing	4/16	Complete
4/17 - 4/23 Week 14	**Executive Summary**	4/17	In Progress
	Advisor Meeting 12	4/17	Scheduled

4/24 - 4/30 Week 15	Final Pressentations	4/24	Not Started
	Final Journal Due	4/29	Not Started
	Client Evaluation	4/29	Not Started
	Email Report and Notebook to Client	4/29	Not Started
	Advisor Meeting 13	4/24	Scheduled
4/31 - 5/6 Week 16	Advisor Meeting 14	5/6	Scheduled
VET CONFERENCE JUNE 4 & 5			

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	