The Knotorious Five

February 14 - February 19

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 ordered and received our Raspberry Pi materials. We assembled the Pi board and case. Our original dataset was increased, augmented, and K-fold cross validation was performed using the augmented images. We met with Dr. Adamczyk to discuss our use of Raspberry Pi and our plan to implement it into the project's final user interface design. Lastly, the second model was trained on the augmented images.

Team Goals:

Next week, the team hopes to upload the new model onto the Pi board and create a circuit that integrates the LEDs, button, and camera. We also plan to complete our preliminary report and ensure the camera is capturing the correct field of view for this application.

Individual Accomplishments:

- Lucy: This week, I picked up the ordered materials at the School of Veterinary Medicine and worked with the team to begin assembling the Raspberry Pi components. I attended the team's meeting with Dr. Adamczyk, gathering advice on the implementation of a Raspberry Pi 5 into our training system. I conducted personal research based on the resources Dr. Adamczyk shared, exploring how to autostart Raspberry Pi and details on General-Purpose Input/Output (GPIO) pins specific to version 5.
- Presley: This week, I worked with the team to assemble the Raspberry Pi components. I also attended the meeting with Dr. Adamczyk to talk through our ideas and any questions we had regarding the Raspberry Pi. I also did research regarding loading our model onto the Raspberry Pi board.
- Maddie: This week I helped the team order and assemble our materials. I also attended a meeting with Dr. Adamczyk where we validated our plan and process to create our user interface. Lastly, I worked on the new model's setup and training. I created code to edit the resolution of the images captured to a consistent resolution. Next, I took the augmented images from Sadie to use in k-fold cross validation for the new model. The augmented images performed worse than we expected in k-fold cross validation, with an average accuracy of 54%. Lastly, I trained another ResNet50 model using the augmented images.
- Kate: This week, I met with the team to assemble the Raspberry Pi components after they arrived at the client's office. This week, I designed and created a schematic for the hardware. I also attended a meeting with Dr. Adamczyk in which we discussed hardware schematics, coding, and booting the Raspberry Pi.
- Sadie: This week, I met with the team to begin assembling Raspberry Pi components. I created a fabrication protocol following our process. I also attended the meeting with Dr. Adamczyk to learn more about how to integrate our model into an automated workflow. I completed image augmentation on the edited dataset, bringing 276 images to 828 total images. I have also spent some time looking into the best way to load our model onto the Pi board.

Individual Struggles:

- Lucy: No struggles this week.
- Presley: No struggles this week.
- Maddie: I am struggling to evaluate the effectiveness of the new model, as it performed poorly in k-fold cross validation.
- Kate: No struggles this week.
- Sadie: No struggles this week.

Individual Goals:

- Lucy: I plan to pilot running our model on the Raspberry Pi using stock images and begin preparing a preliminary report.
- Presley: I hope to have the Raspberry Pi set up and the model loaded onto the board.
- Maddie: I hope to have a complete draft of the code we will use to create and maintain the full user interface workflow.
- Kate: I will build the hardware schematic and potentially add a digit screen. I would like to get the old model uploaded to the board.
- Sadie: Next week, my main goal is to get the model (from last semester) loaded onto the Raspberry Pi and confirm whether it will work or not by downloading stock images for the model to process. After confirming this, we will hopefully have the updated model and better understand the process of implementing it.

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	In Progress
	Team Meeting 4	2/18	Completed
	Advisor Meeting 4	2/20	Scheduled

2/20 - 2/26 Week 5	Preliminary Deliverables	2/25	Not Started
	Upload Model onto Pi	2/20	Not Started
	Team Meeting 5	2/23	Scheduled
	Advisor Meeting 5	2/27	Scheduled
2/27 - 3/6 Week 6	Submit Patent to WARF or IDR	3/6	Not Started
3/7 - 3/13 Week 7			
3/13 - 3/19 Week 8			
3/20 - 3/26 Week 9	**Show and Tell**	**3/20**	Not Started
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	