The Knotorious Five

March 13 - March 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
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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 set up the camera and successfully ran code to take an image, run it through the model, and save the image and model output to our pi device. We grabbed screws to fasten the camera to the stand and plan to utilize this camera setup to take images to refine our model in the upcoming weeks. The team also worked to integrate our model code with a breadboard to use LED lighting to indicate model processes to the user. We also received our acceptance into the VAAMC Conference and registered to present!

Team Goals:

Next week, the team hopes to complete taking images and tying knots for new model training. We can then, easily, upload this model in replacement of the first model we currently have running on our pi.

Individual Accomplishments:

- Lucy: This week, I picked up new sutures from veterinary school. I then tied 50+ knots on the skin pad and took consistent photos of the HQ camera to retrain the model on the newly-ties suture knot.
- Presley: This week, I met with a computer science TA to integrate the model into the raspberry pi virtual environment. I went with the team to get small screws from the Makerspace and we were able to fasten the HQ camera to the camera stand. We also took photos of newly-tied suture knots with the HQ camera to get a new data set to train another model.
- Maddie: This week, I met with a TA within the computer science department to work through our model difficulties on the pi. We were able to fully integrate our model in a virtual environment on the pi. Along with the model running, we could take an image with the camera, save the image, and save the model's outputs in a csv file on the pi using a .py file. I also helped tie some square knots for further model training.
- Sadie: This week, I tied knots to rebuild the dataset and I took images of each of the knots with the Pi HQ camera. These images will be processed and then used to retain the model. This way, all sutures are a consistent color (black) with a light background and were captured from a consistent angle.
- Kate: This week, I attended a meeting with a TA in the computer science department to work on getting the ML model working in the Pi. After the meeting, we were able to get the model working in the terminal, without the need of Jupyter notebook. We were also able to get the Pi to snap a picture and upload the picture to the model and receive an output that was saved with the picture in a CSV file. We got tiny screws and screwed the camera onto the 3D printed stand. I also received new suture materials and tied a skin pad of new square knots for building a new, variable-controlled database. I met with the team and took pictures of the knots using the Pi (which will be used to train a new model).

Individual Struggles:

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

Individual Goals:

- Lucy: I would like to focus on getting the full PI system workflow running and maintaining clear documentation so we can easily resume work after spring break.
- Presley: I would like to work with the team to get a full integration of the classification system.

- Maddie: My goal for next week is to have the full pi system workflow running (button, LEDs, camera, model, output)
- Sadie: Next week, I would like to get the full Pi system working where the button takes a picture, runs it through a model, and outputs the results on an LED. Next, we will conduct testing.
- Kate: I would like to have the whole Pi system working with integration of the button and LEDs. I would also like to refine the design of the camera stand.

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	2/20	Done

	Pi		
	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**	Scheduled
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	