Title: Ski jump launch trainer (ski jump)

Date: 10/03/2025 - 10/09/2025

Client: Prof. Walter Block and Dr. Azam Ahmed

Advisor: Prof. Randy Bartels

Team:

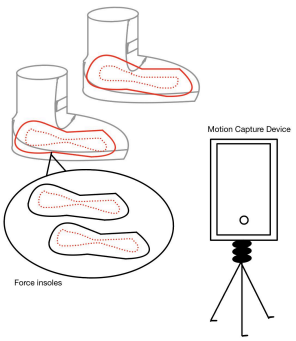
- Team Leader: Kenneth Sun
- BSAC: Caleb White
- Team Communicator: Presley Stellflue
- BPAG: Sarah Kong
- BWIG: Matthew Niemuth

Problem statement: Develop and prototype a comprehensive training system that will allow young skiers learning to jump direct comparison of their technique to professionals utilizing force plates and motion capture.

Brief status update: The Team met last week to break down the project into motion capture done by Juniors and Force Plate Fabrication done by Sophomores. Initial force plate components were purchased and fabrication is under way. Motion capture initial video capture is getting done today and Kinovea testing from sample video of ski jump via the coach has been performed. Next steps are to figure out a date for extensive data collection with both force plates and motion capture.

Difficulties / advice requests: Figuring out exactly what sensors to utilize to quantify the more qualitative aspects of ski jumping (IMU's or not). Make sure data collection is smooth and accurate.

Current design:



Summary of Weekly Individual Accomplishments:

- Kenneth Sun: This week I met with Dr.Willie to ask her about how to optimize video capture for 2D video analysis of ski jumping. She mentioned video quality and frames and the need to parallel orientation to subject. Caleb and I then went to the ski hill to get preliminary video data.
- Caleb White: Trained with Kiovea by analyzing angle progression on both youth athlete and olympic footage. Ordered and received parts from Adafruit including accelerometers, Velostat, and copper tape. Wrote the initial base code for the Arduino pressure sensor code for both gathering and saving data through Arduino's internal EEPROM system.
- Presley Stellflue: Concluded that we will have to look into the biomechanics of the skier and their spine and skeletal system for the proper function of our design. Sketched design ideas for our three design possibilities and did research on the benefits and limitations of each design, along with finding scientific articles to reference for the dimensions of our designs.
- Sarah Kong: Researched about connecting Velostat pressure sensors to Arduino using a breadboard to experiment with the wire connectivity. 3D-Printed various sizes of the force insoles with different materials (TPU vs. PLA) to establish which would be best for our purposes.
- Matthew Niemuth: Went to Wendt to print TPU force insoles and found we want to use another material in case TPU is too flimsy. Also looked into how we are going to code the Arduino to gather data from the accelerometer. It seems based on the type of accelerometer we get, we download a library for it and the library pretty much has what we need. Still need to test this and play around with the arduino kit.

Upcoming Team Goals: The team is planning to return to the Blackhawk Ski Club this upcoming week to test Dartfish or Kinovea after learning about the limited Wifi signal available at the hill. The group has also decided to begin fabricating force insoles rather than purchasing which is more cost effective since the only necessary sensor to measure ground reaction forces while jumping would be at the ball of the foot.

Upcoming Individual Goals:

- Kenneth Sun: Use the video data captured from the athletes to figure out Kinovea capabilities. Work out how to get data of the different angles and figure out if we can get some kinematics data from the motion capture video as well. If not, look into timing gates or IMU for that.
- Caleb White: Use the video captured at the ski hill to further get used to Kinovea and show proof of concept. Reference Dr. Willie's lab guide for matlab code. Help the sophomores develop the force plate using my BME 310 kit by using my Arduino Uno

and various wires and breadboards. Also get the accelerometers working through the Arduino.

- Presley Stellflue: Will work to understand the Arduino software that we will use to program the force plates. I will also continue my research on what aspects we need to incorporate into our force plate to measure specifically the reaction force from the foot off of the ground/launch.
- Sarah Kong: Print size 8 force insole template to fit our client's ski boot. Use an Arduino kit to start fabricating the force plate and begin coding in Arduino IDE to interpret the data. Test the force plate insole metrics before heading out to the ski hill again.
- Matthew Niemuth: Use an Arduino kit to start making our force plates with the printed out insoles. Get an accelerometer and begin coding the Arduino to capture and interpret the data from it. Then test our code and try to collect data from a regular jump to see if it works before heading to the ski hill to test with an athlete's jump.

Materials and expenses:

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	QTY	Cost Each	Total	Link
Motion Capture System										
Tripod with Bag	60 inch lightweight tripod with adjustable-height legs and rubber feet, compatible with smartphone adapters.	Amazon Basics	WT3540	Amazon	B005KP473Q	10/1/2025	2	$25.99	$51.98	Amazon BasicsTripod
Tripod Mount Adapter	Smartphone holder, vertical and horizontal mount adapters for smart phones. Pack of 2	Sharing Moment Co.	H-200112	Amazon	B07S8TTH34	10/1/2025	1	$6.99	$6.99	Amazon TripodMount
Force Plate Insoles										
Force Insole Template	TPU 3D-printed template for force plate insole made of, 18.3 cm long	N/A	N/A	Wendt	N/A	10/10/2025	1	$0.72	$0.72	N/A
Force Insole Template	PLA 3D-printed template for force plate insole made of, 18.3 cm long	N/A	N/A	Wendt	N/A	10/13/2025	1	$0.56	$0.56	N/A
Force Insole	PLA 3D-printed template for force plate	N/A	N/A	Wendt	N/A	10/15/2025	1	$0.59	$0.59	N/A

Template	insole made of, 20.8 cm long									
Velostat	Pressure-Sensitive Conductive Sheet 28cm x 28cm	Adafruit	1361	Adafruit	1361	10/16/2025	1	$4.95	$4.95	Velostat
Copper Tape	Copper foil tape with conductive adhesive 6mm x 15m	Adafruit	1128	Adafruit	1128	10/16/2025	1	$5.95	$5.95	Copper Tape
Accelerometers	ISM330DHCX - 6 DOF IMU - Accelerometer and Gyroscope	Adafruit	4502	Adafruit	4502	10/16/2025	2	$19.95	$39.90	Accelerometers

Timeline:

Task	Sep			Oct					Nov				Dec	
	12	19	26	3	8	17	24	31	7	14	21	28	5	10
Project R&D														
Research	X	X	X	X	X	X								
Design			X	X	X	X								
Prototyping				X	X	X								
Testings														
Deliverables														
Progress Reports	X	X	X	X	X	X								
PDS		X												
Design Matrix			X											
Prelim Presentation				X										
Prelim Report					X									
Final Poster														
Final Report														
Meetings														
Client		X												
Advisor	X	X	X	X	X	X								
Website														
Update	X	X	X	X	X	X								

Filled boxes = projected timeline

X = task was worked on or completed