BME Design-Fall 2025 - Logan Olivera Complete Notebook

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KALOB KIMMEL

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KALOB KIMMEL - Dec 10, 2025, 9:59 PM CST

Last Name	First Name	Role	E-mail	Phone	Office Room/Building
		Advisor			
Herzfeld	David	Client	david.herzfeld@wisc.edu		
Olivera	Logan	Leader	lolivera@wisc.edu	6085566712	
Stewart	Jackson	Communicator	jtstewart5@wisc.edu	269-910-0268	
Dirkse	Andrew	BSAC	adirkse@wisc.edu	920-400-0544	
Bhatt	Sameer	BWIG	sbhatt9@wisc.edu	262-327-6956	
Fischesser	Charlie	BPAG	fischesser@wisc.edu	630-346-4224	



Charlie Fischesser - Sep 07, 2025, 11:13 PM CDT

Course Number:

BME 300/200

Project Name:

Modular touchscreen-based training device for rhesus macaque in-cage behavioral training

Short Name:

User interface with reward system

Project description/problem statement:

This project aims to design and prototype a modular, cage-mounted touchscreen training system for rhesus macaques that enables safe and efficient delivery of visual behavioral tasks in the animals' home environment. The eventual device should feature a rugged touchscreen interface, TTL-triggered liquid reward delivery system, and synchronization outputs for compatibility with future neurophysiological recording systems. Designed to mount securely to a variety of cage types without modification, the system will allow primates to interact with behavioral tasks while remaining safely enclosed in their home cage and engaging with these tasks at their own leisure.

The final product will emphasize animal safety, durability, and ease of use, with no exposed wiring, sharp edges, or risk of injury to the animal. It will operate without the need for an internet connection, storing data locally while supporting Ethernet and standard power inputs. By focusing on modularity, the ideal system will be extensible for different reward types and task paradigms, with an open API to allow researchers to define task logic externally.

About the client:

Professor David Herzfeld completed a post-doctoral fellowship in Neurobiology with Stephen G. Lisberger at Duke following completion of his PhD in Biomedical Engineering at Johns Hopkins with Reza Shadmehr. He now runs the Herzfeld lab at the University of Wisconsin studying neural circuits with respect to complex behaviors in animals.

Logan Olivera - Sep 10, 2025, 8:51 AM CDT

Title: Client Meeting #1

Date: 2025/09/08

Content by: Logan Olivera

Present: Everyone in BME group and Dr. Herzfeld

Goals: Meet Dr. Herzfeld, get a general overview of the project and see plan/schedule future oppertunites.

Content:

The herzfeld lab researches how the brain and nerual circuits coordinate activity to drive behavior.

This meeting lasted 30 minutes covering the following topics:

- General overview of the project

This device is intended to be stably mounted to a small cage houseing one of the monkeys (roughly the size of a toddler). It should not need any researcher oversight to be operated by the monkey. Consists of a touchscreen, very basic software (this will be developed by the research team) and a reward system. There are existing prodcts but nothing that matches exactly the clients needs and costs > \$100,000.

- Budget

Budget is loose for this project but general goal to stay under is \$5000. If a higher budget is needed that is okay as well.

- Access to WIMR and its resources was discussed

We will get access to WIMR 3rd and 5th floor, this includes primate research center, and other tools that may be needed such as 3D printers.

- General Design Ideas

General design ideas were discussed with the leading idea being a rasberry pi being the center of the system, interfacting with a touchscreen which then communicates to a pump or some liquid despensing device.

Conclusions/action items: Attend our advisor meeting, update him on the project discription. Meet with the group to discuss designs and research. Complete first progress report.

KALOB KIMMEL - Sep 22, 2025, 1:54 PM CDT

Title: Client Meeting #1
Date : 2025/09/08
Content by: Logan Olivera
Present: Everyone in BME group and Dr. Herzfeld
Goals: Discuss initial design considerations and outline a plan to purchase items, begin documentation and prototyping.
Content:
Questions to ask:
Power layout
Touchscreen size - ipad
Storage system - ssh access - data files on that sd card but also. Try to find usb or usbc plug in (could be through arduino circuit)
Failure methods - how to notify. Water regulated (keep close eye on water intake). Will be human checks. Check when water actually goes out may be hard to implement. Worst failure method, trials with no data. Device do nothing is somewhat okay but not ideal. MOUNTIAN METHOD IS IMPROTANT.
Purschaing methods Shop@uw main
Maybe use latches with a lock on one or two of the latches. Or u-bolt
Tubing to contain cableing
Metal box at the end - prototyping with 3D printing - pla
look up project boxes
Use a magnet based signal that says if the latch is on or not, this will stop or continue expiements.
3d print our own cage
pumps are 24dc NOT AC
Write documentation for how to output signal and what
Give us peristaltic pump
Piece of cage

Start off with overview of our design idea. Looking at components we will need to interact with (pump and cage).

Conclusions/action items:

lp 6/7

Will get input after design matrix

Once tested with animals we will know more, so make sure that it is easy to upgare - standard sizes, etc

metal tubing - mcmaster car

we can

- 15 - 30 milliseconds for pump

600 ml of juice per day about

most of the time device will be on the bottom

Make sure orientation of tubing and screen makes it possible to have mouth on tube while using touchscreen.

Not concerned about weight

moved on cart most likely

look into outsourcing

Can't be accessed outside, hard

Logan Olivera - Sep 29, 2025, 1:35 PM CDT

Title:	Client	Meeting	#4

Date: 2025/09/29

Content by: Logan Olivera

Present: Everyone in BME group and Dr. Herzfeld

Goals: Update Dr. Herzfeld on the status of our project and future direction

Content:

To be discussed:

More in depth update at poster presentation where specifics will be discussed.

- Status
- Presentation on Friday
- In presentation we will have basic mechancial prototype as well as general electronics/code complete.
- Plan to finalize mechancial prototype design this week and create following week.

Starts with a quick weekly overview and plan for the following week. Showing our client mechancial designs.

Design 2 is leading design.

Touchscreen is 12v power supply.

What size screen would we like to go: 8-10 in screen

1.25 in by 1.25 in cells

Final presentaiton not 1-2 pm

Logan Olivera - Oct 06, 2025, 1:13 PM CDT

Title: Client Meeting #5

Date: 2025/10/6

Content by: Logan Olivera

Present: Dr. Herzfeld, Logan, Charlie and Jackson

Goals: Update Dr. Herzfeld on the status of our project and future direction

Content:

To Be Discussed:

Update on presentation and how that went

Update on report

- Group is very busy with exams so this week will probably not be the most productive
- Order monitor (I will start pressing Sammer and Charlie to get on this)
- Raspberry pi ordering

Sameer Bhatt - Oct 27, 2025, 1:15 PM CDT

Title: Client Meeting #5

Date: 2025/10/6

Content by: Logan Olivera

Present: Dr. Herzfeld, Logan, Charlie and Jackson

Goals: Update Dr. Herzfeld on the status of our project and future direction

Content:

To Be Discussed:

Update on presentation and how that went

Update on report

- Group is very busy with exams so this week will probably not be the most productive
- Order monitor (I will start pressing Sammer and Charlie to get on this)
- Raspberry pi ordering

Logan Olivera - Nov 10, 2025, 1:21 PM CST

Title: Client Meeting #7
Date: 11/10/25
Content by: Logan Olivera
Present: Logan, Sameer and Jackson
Goals: Update Client on progress
Content:
We are 3D printing design where there is one box holding screen and hole for the tubing from pump. Ensure its waterproof with a rubber oring or something on the outside
Epoxy based adhesive.
Nuts/bolts for plastic.
Metal nozzle for tubing.
Conclusions/action items:

Logan Olivera - Sep 10, 2025, 9:31 AM CDT

Title: Advisor Meeting #1
Date: 09/10/2025
Content by: Logan Olivera
Present: BME team and advisor
Goals: Update our advisor on the project description as well as our plans to move forward and hear his feedback.
Content:
First off, set new advisor meeting date which is Friday at 4:30pm weekly.
Introductions: Meeting the advisor and explaining why we picked the project we did and what coursework/expierence we have respectivly.
Keep screen inside cage
Rasberri pi based touchscreen
Questions to ask:
Power supply
Alarming system
Failure methods
Current failsafe
How does client want to know when something fails.
Conclusions/action items:

Logan Olivera - Sep 19, 2025, 5:03 PM CDT

Title: Advisor Meeting #2

Date: 09/19/2025

Content by: Logan Olivera

Present: Everybody in group

Goals: Update our advisor on the status of the project.

Content:

First off discussing lab archives and how we should format for future reference.

Going member to discuss what we did last week and plans for the next week.

Get a tube from the client to test liquid output.

Next week:

- Purchase all materials needed such as screens and power supplies
- Design matrix for casing and cad model
- Finishing pump system and start calibrating output
- How we will mount to cage
- Cylindrical latches
- All electronics NEED to be enclosed
- MONKEY PROOF

Begin design matrix this weekend and have 3 truly competing designs.

Lab archives Lab archives lab archives - said 3 times so do it :)

Logan Olivera - Sep 26, 2025, 5:03 PM CDT

Title: Advisor Meeting #3
Date: 09/26/2025
Content by: Logan Olivera
Present: Everybody in group
Goals: Update our advisor on the status of the project.
Content:
More clearly define notification/failure system in the pds. This also goes for being modifiable.
More touchscreen information in the pds.
Comparison between Thomas system vs ours.
Presentation details for the upcoming Friday:
- Invite client to presentation
- Inform client about poster session at end of semester - same email
- Professional attire
- Upload link to website of the presentation in slides and pdf
Matrix of comparison of for our design vs existing design.
our tolerances are more strict than clients.
Past week:
A bunch of designing and planning
Following week:
Presentations

Basic circuitry done
Pick mechanical design
Order raspberry pi's
two displays
cheap displays
Main design out of aluminum and see if we can transfer to stainless steel after.
Order by Monday.
Conclusions/action items:

Logan Olivera - Sep 29, 2025, 1:08 PM CDT

Title: Advisor Meeting #3
Date: 09/26/2025
Content by: Logan Olivera
Present: Everybody in group
Goals: Update our advisor on the status of the project.
Content:
Past week:
A bunch of designing and planning
Following week:
Presentations
Basic circuitry done
Pick mechanical design
Order raspberry pi's
two displays
cheap displays
Main design out of aluminum and see if we can transfer to stainless steel after.
Order by Monday.

KALOB KIMMEL - Oct 03, 2025, 4:48 PM CDT

Title: Advisor Meeting #5
Date: 10/3/2025
Content by: Kalob Kimmel
Present: Everybody in group
Goals: Update our advisor on the status of the project.
Content:
Past week:
Designing and working on preliminary presentation
Following week:
Preliminary report
Future work reiterate safety
Future work timeline/milestones
Advisor out of town for next two weeks so meet on zoom
Overall presentation was good
Look into printing design as well as starting locking mechanism

Overall advisor was happy with progress and presentation!

Logan Olivera - Nov 07, 2025, 4:54 PM CST

Title: Advisor Meeting #6
Date: 11/7/25
Content by: Logan Olivera
Present: Everybody in group
Goals: Update our advisor on the status of the project.
Content:
Not using metal anymore, using petg from 3D printing. Two box system with one on cart.
Buy fish pump.
Badger game (snake with badger)
Conclusions/action items:

Logan Olivera - Nov 14, 2025, 4:51 PM CST

Title: Advisor Meeting

Date: 11/14/25

Content by: Logan Olviera

Present: Charlie, Jackson, Sameer and Logan

Goals: Update Advisor

Content:

1.) GET FISH PUMP - PRIORITY

last bottleneck is the pump not running. We have printing going right now.

Logan Olivera - Sep 28, 2025, 9:15 PM CDT

Title: Ras Pi Archetcture

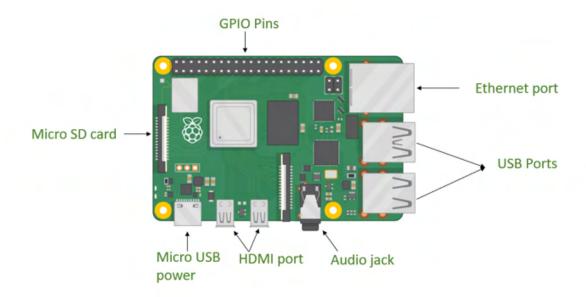
Date: 09/28/2025

Content by:

Present:

Goals:

Content:





2025/09/28-Motor Controller Archetricture

Logan Olivera - Sep 28, 2025, 9:21 PM CDT

Title: Motor Controller

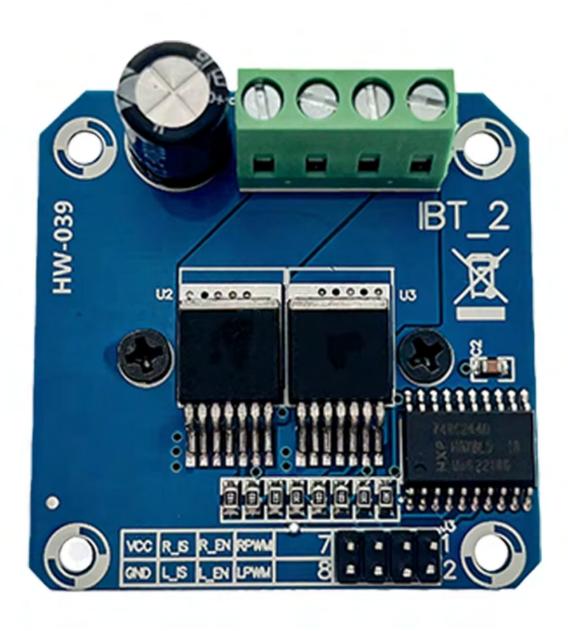
Date: 09/28/2025

Content by:

Present:

Goals:

Content:



Logan Olivera - Nov 25, 2025, 5:22 PM CST

import RPi.GPIO as GPIO #type: ignore	
import time	
# Set pin numbers	
RPWM = 18 # PWM-capable physical 12 - brown	
LPWM = 19 # PWM-capable (or 13) - physical 35 - orange	
REN = 23 # physical 16 - yellow	
LEN = 24 # physical 18 - teal	
F_PWM = 2000 # use 200 Hz for visual LED test; 20000 for motor	
pump_time = 0.5 # Calibrated time (ms) for output of liquid	

GPIO.setmode(GPIO.BCM)
---------------	-----------

GPIO.setwarnings(False)

GPIO.setup(REN, GPIO.OUT, initial=0)

GPIO.setup(LEN, GPIO.OUT, initial=0)

GPIO.setup(RPWM, GPIO.OUT)

GPIO.setup(LPWM, GPIO.OUT)

 $forward_pwm = GPIO.PWM(RPWM, F_PWM)$

reverse_pwm = GPIO.PWM(LPWM, F_PWM)

forward_pwm.start(0)

reverse_pwm.start(0)

def clamp(x): return max(0, min(100, x))

```
def forward(duty):
  duty = clamp(duty)
  GPIO.output(REN, 1)
  GPIO.output(LEN, 1)
  reverse_pwm.ChangeDutyCycle(0)
  forward_pwm.ChangeDutyCycle(duty)
def reverse(duty):
  duty = clamp(duty)
  GPIO.output(REN, 1)
  GPIO.output(LEN, 1)
  forward_pwm.ChangeDutyCycle(0)
  reverse_pwm.ChangeDutyCycle(duty)
```

def coast():
GPIO.output(REN, 0)
GPIO.output(LEN, 0)
forward_pwm.ChangeDutyCycle(0)
reverse_pwm.ChangeDutyCycle(0)
Calls forward for a given amount of time
Time will be calivrated for now will run for 500 ms
def pump(duration = pump_time):
forward(100)
time.sleep(duration) #type:ignore
coast()

Test

pump(5)

Charlie Fischesser - Oct 03, 2025, 2:33 PM CDT

Title: Expenses Sheet (as of 10/3/2025)

Date: 10/3/2025

Content by: Charlie Fischesser

Present: Charlie Fischesser

Goals:

To create and update an expenses sheet with information regarding serial numbers to copy project costs

Content:

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	QTY	Cost Each	Total	Link
Electronics										
	Advanced Raspberry Pi used to send out									
Raspberry Pi Model 3 B+	signals for motor controller	N/A	SC0073	UW Makerspace	SC0073	9/15/2025	1	\$45.00	\$45.00	https://www.raspberrypi.com/products/raspberry-pi-3-model-b-plus/
Wiring	Wiring to connect Raspberry Pi	N/A	N/A	UW Makerspace	N/A	9/22/2025	1	\$1.00	\$1.00	
Micro SD	Store Research data for researchers	N/A	N/A	UW Makerspace	N/A	9/15/2025	1	\$4.00	\$4.00	
Motor Controller	Connects to Raspberry Pi to initiate pump	Hiletgo	3-01-833	Amazon	3-01-833	9/22/2025	1	\$10.99	\$10.99	https://www.amazon.com/dp/B00WSN98DC?ref=ppx_yo2ov_dt_b_fed_asin_title_
Mechanical										
A300BXS- Pump	Pump to push fluids	Anko	A302BX-300-S	Anko	A302BX-300-S	9/15/2025	1	Gifted	\$0.00	ANKO A300BX-S OEM Peristaltic Pump Serial Control Brushless DC Models to 1700 mL/min
								TOTAL:	\$60.99	

Conclusions/action items:

Update sheet once new materials are bought (touchscreens/mechanical materials). Find more information about N/A's in chart.

Logan Olivera - Dec 03, 2025, 9:49 PM CST

Title: Expenses Sheet (as of 11/7/2025)

Date: 11/7/2025

Content by: Charlie Fischesser

Present: Charlie Fischesser

Goals:

To create and update an expenses sheet with information regarding serial numbers to copy project costs

Content:

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	QTY	Cost Each	Total	Link
Electronics										
	Advanced Raspberry Pi used to input signals from									
Raspberry Pi Model 3 B +	touchsreen and output signals to motor controller.	N/A		UW Makerspace	SC0073	9/15/2025		1 \$45.00		https://www.raspberrypi.com/products/raspberry-pi-3-model-b-plus/
Wiring	Wiring to connect Raspberry Pi to motor controller	N/A	N/A	UW Makerspace	N/A	9/22/2025		1 \$1.00		
Micro SD	Store data for researchers	N/A	N/A	UW Makerspace	N/A	9/15/2025		1 \$4.00	\$4.00	
	Connects to Raspberry Pi to output signals to turn on pump device	Hitilego	3-01-833	Amazon	3-01-833	9/22/2025		1 \$1.00	\$1.00	https://www.amazon.com/dp/B00WSN98DC?ref=ppx&th=1
Mechanical										
	Pump to push fluids by accepting signals from motor controller.	Anko	A300BX-S	Anko	A302BX-300-5	9/15/2025		1 Gifted	\$575.00	ANKO A300BX-S OEM Peristaltic Pump Serial Control Brushless DC Models to 1700 mL/min
8 inch GreenTouch	Touchscreen device with high water and impact									https://www.walmart.com/ip/GreenTouch-8-inch-Open-Frame-1024x600-HDMI-PCAP-Touch-
Touchscreen	resistance and USB ports to connect to raspberry Pi	GreenTouch	GT-TM080(2C	Walmart	GT-TM080	10/14/2025		1 \$200.88	\$200.88	Monitors-for-Consumer-Retail-POS-and-Hospitality-Markets/15594114325?classType=REGULAR
Power										
24V 2A 48W DC barrel power	Power supply to safely power the motor controller,									
supply (2 Pack)	touchscreen, raspberry pi, and pump	Fletergib	N/A	Amazon	BOC6SJY34G	10/29/2025		1 \$16.99	\$16.99	https://www.amazon.com/Supply-Adapter-100-240V-Transformer-Connector/dp/B0C6SJY34G?th=
	Power supply to safely power the motor controller,		JYH36-		J3611204000					https://www.amazon.com/Adapter-Replacement-J361-1204000U-J3611204000U-100-240-
24V 2A DC barrel power supply	touchscreen, raspberry pi, and pump	Onerbl	1204000-BY	N/A	U	10/29/2025		1 Gifted	\$13.89	50/dp/B0D31FRQ9G
								TOTAL:	\$857.76	

Conclusions/action items:

Update sheet if any more materials are purchased. Find more information about N/A's in chart.

Charlie Fischesser - Dec 10, 2025, 7:58 PM CST

Title: Expenses Sheet (updated up to 12/10)

Date: 12/10/2025

Content by: Charlie

Present: Charlie and team

Goals: To create and update an expenses sheet with information regarding serial numbers to copy project costs

Content:

Raspberry Pi Model 3 B + and output sign Moro SD Store data for a Connects to Rat Motor Controller device Mschanical A300BXS-Pump Pump to push f Touchscreen di Si inch GreenTouch Touchscreen 24V DC Vacuum Peristaltic Pump Power	Raspberry Pi to output signals to turn on pump		SC0073 N/A N/A 3-01-833 A3008X-S	UW Makerspace UW Makerspace UW Makerspace Amazon	N/A	9/15/2025 9/22/2025 9/15/2025 9/22/2025 9/15/2025		1 \$45.00 1 \$1.00 1 \$4.00 1 \$4.00	\$1.00 \$4.00	https://www.raspberrypi.com/products/raspberry-pi-3-model-b-plus/ https://www.amazon.com/dp/B00WSN8BDC?ref=pps&th=1
Raspberry Pi Model 3 B + and output sign wiring to consist of the connects to Rate data for a Connects to Rate device Mechanical Binch GreenTouch Touchscreen dust of Connects to Connects to Rate device device device (Connects to Rate device) Binch GreenTouch Touchscreen dust port to co 2000 port to co 2000 power Dower	ignals to motor controller, nect Rapberry Pt to motor controller researchers Raspberry Pt to output signals to turn on pump things by accepting signals from motor controller. device with high water and impact resistance and	N/A N/A Hitilego	N/A N/A 3-01-833	UW Makerspace UW Makerspace Amazon	N/A N/A 3-01-833	9/22/2025 9/15/2025 9/22/2025		1 \$1.00 1 \$4.00 1 \$1.00	\$1.00 \$4.00	
Wiring to consommer of the controller of the connects to Rat device of the Rat device of the Connects to Rat device of the Con	nect Baspberry Pi to motor controller researchers researchers haspberry Pi to output signals to turn on pump in fluids by accepting signals from motor controller. device with high water and impact resistance and	N/A N/A Hitilego	N/A N/A 3-01-833	UW Makerspace UW Makerspace Amazon	N/A N/A 3-01-833	9/22/2025 9/15/2025 9/22/2025		1 \$1.00 1 \$4.00 1 \$1.00	\$1.00 \$4.00	
Micro SD Store data for Connects to Rar device Mechanical Store data for Connects to Rar device Mechanical Pump to push Touchscreen data for GreenTouch Touchscreen data for Court of C	r researchers Raspberry Pi to output signals to turn on pump In fluids by accepting signals from motor controller. device with high water and impact resistance and	N/A Hitilego	N/A 3-01-833	UW Makerspace Amazon	N/A 3-01-833	9/15/2025		1 \$4.00 1 \$1.00	\$4.00	https://www.amazon.com/dg/B00WSN96DC?ref=pps&th=1
Motor Controller device Mechanical A3008XS- Pump Pump to push f Touchscreen d USB ports to co 24V DC Vacuum Peristaltic Pump Power	Raspberry Pi to output signals to turn on pump If fluids by accepting signals from motor controller. device with high water and impact resistance and	Hitilego	3-01-833	Amazon	3-01-833	9/22/2025		1 \$1.00		https://www.amazon.com/dp/B00WSN98DC/tref=pps&th=1
Motor Controller device Mechanical A300BXS- Pump Pump to push f Touchscreen d USB ports to co 24V DC Vacuum Peristaltic Pump Power	h fluids by accepting signals from motor controller. device with high water and impact resistance and	Anko							\$1.00	https://www.amazon.com/dp/B00WSN98DC?ref=ppx8th=1
A300BXS- Pump Pump to push f Touchicreen de USB ports to co 24V DC Vacuum Peristaltic Pump Power	device with high water and impact resistance and		A300BX-S	Anko	A302BX-300-5					
8 inch GreenTouch Touchscreen du USB ports to co 24V DC Vacuum Peristaltic Pump Pump to replac	device with high water and impact resistance and		A300BX-S	Anko	A3028X-300-S	9/15/2025				
8 inch GreenTouch Touchscreen du USB ports to co 24V DC Vacuum Peristaltic Pump Pump to replac	device with high water and impact resistance and		A3008X-S	Anko	A3028X-300-S	9/15/2025				
8 inch GreenTouch Touchscreen USB ports to co 24V DC Vacuum Peristaltic Pump Pump to replac Power								1 Gifted	\$575.00	ANKO A300BX-S OEM Peristaltic Pump Serial Control Brushless DC Models to 1700 mL/min
Power		GreenTouch	GT-TM080(2C) Walmart	GT-TM080	10/14/2025		1 \$200.88		https://www.walmart.com/ip/GreenTouch-8-inch-Open-Frame-1024x500-HDMI-PCAP-Touch- Monitors-for-Consumer-Retail-POS-and-Hospitality-Markets/155941143257classType-REGULAR
	lace previous broken pump to do same function	Hilitand	B08NBDNPL4	Amazon	B08NBDNPL4	11/21/2025		1 \$46.39	\$46.39	https://www.amazon.com/dp/B08NBDNPL4
ANTAL MINISTER CONTRACTOR OF THE PROPERTY OF T										
24V 2A 48W DC barrel power Power supply to supply (2 Pack) raspberry pi, and	to safely power the motor controller, touchscreen, and pump	Fletergib	N/A	Amazon	B0C6SJY34G	10/29/2025		1 \$16.99	\$16.99	https://www.amazon.com/Supply-Adapter-100-240V-Transformer-Connector/dp/B0C6SJY34G?th=
Power supply to 24V 2A DC barrel power supply raspberry pi, ar	y to safely power the motor controller, touchscreen, and pump	Onerbl	JYH36- 1204000-BY	N/A	J3611204000 U	10/29/2025		1 Gifted	\$13.89	https://www.amazon.com/Adapter-Replacement-J361-1204000U-J3611204000U-100-240- 50/do/80D31FRO9G
3D Printing										
Print Costs Printing costs fo	s for multiple prototype prints throughout semester	N/A	N/A	UW Makerspace	N/A	N/A	N/A	N/A	\$75.00	
-								TOTAL:	979.15	

Conclusions/action items:

Finished expenses sheet. Turn in any final assignments.

Conclusions/action items:

Logan Olivera - Nov 25, 2025, 10:04 AM CST

Title: Pump Output Testing Protocol
Date: 11/24/2024
Content by: Logan Olivera
Goals: Create a protocol to calibrate and test the pump.
Content:
Refer to 2025/11/24 - Motor Controller Code in the project files folder under team activities.
THIS IS TO BE DONE ONCE THE PUMP IS CALIBRATED
The



2025/11/25 - Pump Calibration Protocol

Logan Olivera - Nov 25, 2025, 9:45 AM CST

Title: Pump Calibration Protocol

Date: 11/25/25

Content by: Logan Olivera

Goals: Outline a standard method to calibrate the peristaltic pump used in the primate portal system

Content:

The goal of this calibration is to calibrate to 1mL of liquid dispensed (calibrated to water in this scenario).

Materials needed:

- primate portal system
- beaker
- water
- scale

Procedure:

- 1.) Place the beaker on the scale and 0 the scale
- 2.) Refer to the script MotorPackage.py, on this script the two things to be aware of are the variable pump_time initialized at the top line ~ 12 and the function:

```
def pump(time = pump_time):
    forward(100)
    time.sleep(time) #type:ignore in seconds
    coast()
```

Set pump time to a given time (maybe around 0.5 seconds)

3.) run the script to output a given amount of liquid

to actually use the function add at the bottom of the script:

pump()

this should pump water out of the peristaltic pump. Capture this water in the beaker and weigh. The ideal weight should be 1 gram as 1mL = 1g for water

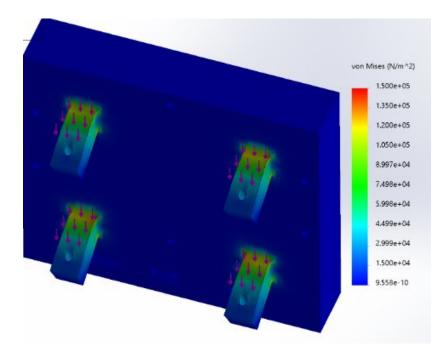
4.) If the weight is off, adjust pump_time accordingly and repeat this process (zero beaker + water). Do until the outputted amount of water is 1g +- 0.05g



12/9/2025 Solid works Testing on Final

KALOB KIMMEL - Dec 09, 2025, 8:11 AM CST

Here is the solid works testing for the final design of the case. We applied a 88 Newtons of force on the four bars that hold the case in place. From this we found that the failure load was 1.5 x 10^5 Pa. Taking that the maximum expected load is 88 N and that will be distributed over the0.00129 m^2 we are given a maximum expected stress of 6.89x 10^4 Pa. 1.5 x 10^5 Pa/ 6.89x 10^4 Pa gives us the factor of safety which is 2.18. This is a satisfactory result because it is over the point of 2 meaning it can carry over double the maximum expected load. As you can see from the image below, most of the stress accumulates at the joint between the back of the case and the bars, which was accommodated by a fillet to help distribute the load.





Logan Olivera - Nov 24, 2025, 1:06 PM CST

Title: Motor Controller Code

Date: 11/24/25

Content by: Logan Olivera

Goals: Document the code used to control the motor controller and hence the pump

Content:

Written in python

GPIO.output(LEN, 1)

reverse_pwm.ChangeDutyCycle(0)

Logan Olivera - Nov 24, 2025, 1:06 PM CST

import RPi.GPIO as GPIO #type: ignore import time # Set pin numbers RPWM = 18 # PWM-capable physical 12 - brown LPWM = 19 # PWM-capable (or 13) - physical 35 - orange REN = 23 # physical 16 - yellow LEN = 24 # physical 18 - teal F PWM = 20000 # use 200 Hz for visual LED test; 20000 for motor pump_time = 0.5 # Calibrated time (ms) for output of liquid GPIO.setmode(GPIO.BCM) GPIO.setwarnings(False) GPIO.setup(REN, GPIO.OUT, initial=0) GPIO.setup(LEN, GPIO.OUT, initial=0) GPIO.setup(RPWM, GPIO.OUT) GPIO.setup(LPWM, GPIO.OUT) forward pwm = GPIO.PWM(RPWM, F PWM) reverse_pwm = GPIO.PWM(LPWM, F_PWM) forward_pwm.start(0) reverse_pwm.start(0) def clamp(x): return max(0, min(100, x)) def forward(duty): duty = clamp(duty)GPIO.output(REN, 1)

```
forward_pwm.ChangeDutyCycle(duty)
def reverse(duty):
duty = clamp(duty)
GPIO.output(REN, 1)
GPIO.output(LEN, 1)
forward_pwm.ChangeDutyCycle(0)
reverse_pwm.ChangeDutyCycle(duty)
def coast():
GPIO.output(REN, 0)
GPIO.output(LEN, 0)
forward_pwm.ChangeDutyCycle(0)
reverse_pwm.ChangeDutyCycle(0)
# Calls forward for a given amount of time
# Time will be calivrated for now will run for 500 ms
def pump(time = pump_time):
forward(100)
time.sleep(time) #type:ignore
coast()
# Test
pump(2)
```



Progress Report #1

Interactive Touchscreen for Rhesus Macaque

BME 200/300 09/11/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart |communicator), Andrew Birkon BSACI, Sameer Bhett (BWG), Charlle Prochesser (BPAG)

Project Statement: To design amodular, respicery pi based interactive touchscreen, with a corresponding liquid dispensing to observe and understand the cognitive function of complex neural systems.

Download

Progress_Report_1.pdf (184 kB)



Progress Report #2

Interactive Touchscreen for Rhesus Macaque

BME 200/300 09/19/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart |communicator), Andrew Birkon BSACI, Sameer Bhett (BWG), Charlle Prochesser (BPAG)

Project Statement: To design a modular, resphery pi based interactive touchscreen, with a corresponding liquid depending to observe and understand the cognitive function of complex recurs systems.

<u>Download</u>

Progress_Report_2.pdf (194 kB)



Progress Report #3

Interactive Touchscreen for Rhesus Macaque

BME 200/300 09/19/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart |communicator), Andrew Birkon (BSAC), Sameer Bhett (BWG), Charlle Pischesser (BPAG)

Project Statement: To design amodular, respicery pi based interactive touchscreen, with a corresponding liquid dispensing to observe and understand the cognitive function of complex neural systems.

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Progress_Report_3.pdf (195 kB)

KALOB KIMMEL - Dec 09, 2025, 11:29 AM CST



Progress Report #4

Interactive Touchscreen for Rhesus Macaque

BME 200/300 10/03/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart |communicator), Andrew Dirkos (BSAC), Sameer Bhett (DWG), Charlle Prachesser (BPAG)

Project Statement: To design amodular, respicery pi based interactive touchscreen, with a corresponding liquid dispensing to doserve and understand the cognitive function of complex neural systems.

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Progress_Report_4.pdf (264 kB)



Progress Report #5

Interactive Touchscreen for Rhesus Macaque

BME 200/300 10/03/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart |communicator), Andrew Birkon BSACI, Sameer Bhett (BWG), Charlle Prochesser (BPAG)

Project Statement: To design a modular, resphery pi based interactive touchscreen, with a corresponding liquid depending to observe and understand the cognitive function of complex recurs systems.

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Progress Report #6

Interactive Touchscreen for Rhesus Macaque

BME 200/300 10/17/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart |communicator), Andrew Birkon (BSAC), Sameer Bhett (BWG), Charlle Pischesser (BPAG)

Project Statement: To design a modular, resphery pi based interactive touchscreen, with a corresponding liquid depending to observe and understand the cognitive function of complex recurs systems.

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Progress_Report_6.pdf (292 kB)



Progress Report #7

Interactive Touchscreen for Rhesus Macaque

BME 200/300 10/28/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart |communicator), Andrew Birkon (BSAC), Sameer Bhett (BWG), Charlle Pischesser (BPAG)

Project Statement: To design a modular, resphery pi based interactive touchscreen, with a corresponding liquid depending to observe and understand the cognitive function of complex recurs systems.

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Progress Report #8

Interactive Touchscreen for Rhesus Macaque

BME 200/300 10/28/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart |communicator), Andrew Birkon BSACI, Sameer Bhett (BWG), Charlle Prochesser (BPAG)

Project Statement: To design a modular, resphery pi based interactive touchscreen, with a corresponding liquid depending to observe and understand the cognitive function of complex recurs systems.

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Progress_Report_8.pdf (266 kB)



Progress Report #9

Interactive Touchscreen for Rhesus Macaque

BME 200/300 11/7/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart (consmunicator), Andrew Birkon (BSAC), Sameer Bhett (BWG), Charlle Pischesser (BPAG)

Project Statement: To design amodular, respicery pi based interactive touchscreen, with a corresponding liquid dispensing to observe and understand the cognitive function of complex neural systems.

Download

Progress_Report_9.pdf (349 kB)



Progress Report #10

Interactive Touchscreen for Rhesus Macaque

BME 200/300 11/14/2025

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart (consmunicator), Andrew Birkon (BSAC), Sameer Bhett (BWG), Charlle Pischesser (BPAG)

Project Statement: To design a modular, resphery pi based interactive touchscreen, with a corresponding liquid depending to observe and understand the cognitive function of complex recurs systems.

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Progress_Report_10.pdf (348 kB)



Progress Report #11

Interactive Touchscreen for Rhesus Macaque

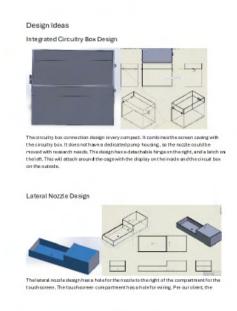
BME 200/300 11/21/2029

Team Members: Logan Olivera (co-Leader), Kalob Kimmel (co-Leader), lackson Stewart (consmunicator), Andrew Birkon (BSAC), Sameer Bhett (BWG), Charlle Pischesser (BPAG)

Project Statement: To design a modular, resphery pi based interactive touchscreen, with a corresponding liquid depending to observe and understand the cognitive function of complex recurs systems.

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Progress_Report_11.pdf (328 kB)



Download

Design_Matrix.pdf (391 kB)





09/18/2025

Primate Partal

BME 301/200 Section 304

Group Members:

Lendere: Kalob Krumel and Logan Olivera Communicator: Jackson Shreart BSAC: Androw Dirlose BWIG: Samort Blant BPAG: Charlie Fischessor

Client: Dr. David Herzfeld Advisor: Dr. Dhanoj sy Baskar

The private portal is intended to be a private positive reinforcement training device. From a higher-lovel perspective, the private portal is a teacherson interface, computing a liquid reveal for the private when it reaccording to expend as rate of the burcherson. From a norw detail-oriented pumper tive, the private portal is a teacherson interface occurred by a Raupherry Pi.

Download

Primate_Portal_PDS.pdf (336 kB)

BME Design: 200, 201, 300, 301, 400 and 402



Primate Portal

BME 200/300 10/10/2025

Client: Dr. David Herzfeld - Department of Neuroscience

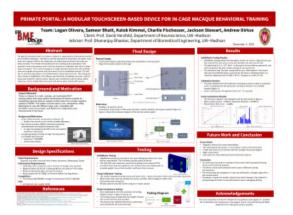
Advisor: Dhananjay Bhaskar

Team Member & Logan Olivera (Co-Leader), Kalob Kimmel (Co-Leader), Sameer Bhatt (BWTG), Andrew Dirkse (BSAC), Jackson Stewart (Communicator) and Charlie Fischesser (BPAG)

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Primate_Portal_Preliminary_Report.pdf (1.42 MB)





Download

Final_poster_BME_300.pdf (1.02 MB)

KALOB KIMMEL - Dec 10, 2025, 10:00 PM CST

BME Design: 200, 201, 300, 301, 400 and 402



Primate Portal

BME 200/300

12/7/2025

Client: Dr. David Herzfeld - Department of Neuroscience

Advisor: Dhananjay Bhaskar

Teien Merishers: Logan Olivera (Co-Leader), Kalob Kimmel (Co-Leader), Sameer Blutt (BWIG), Andrew Dirkoe (BSAC), Jackson Stewart (Communicator) and Charlie Fuchesser (BPAG)

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BME_300-200_Final_Report_1_.pdf (1.42 MB)



2025/09/12-Primate Touchscreen Background Research

Logan Olivera - Sep 12, 2025, 10:32 AM CDT

Title: Primate Touchscreen Bakcground

Date: 09/12/2025

Content by: Logan Olivera

Goals: Gain a base understanding of the cases in which a primate would use a touchscreen system as to design our

project correctly.

Content:

https://asp.org/2024/05/29/touchscreens/

Conclusions/action items:

Logan Olivera - Sep 15, 2025, 9:26 AM CDT

Title: Peristaltic pump function and control

Date: 09/15/2025

Content by: Logan Olivera

Goals: Learn how a peristaltic pump works as well as how we will control it (probably using a 5v output)

Content:

They are a type of positive displacement pump where a roller system compresses the tubing used to push the liquid. It emulates how human muscle contracts to move liquids around.



One major advantage of these pumps is that nothing touches the inside of the tubing other than the liquid and that the tubing can be removed allowing for very easy cleaning.

Above: https://www.wmfts.com/en-us/support/pump-principles/peristaltic-pumps-how-they-work/

Conclusions/action items: Continue research on peristaltic pumps and back emf

Logan Olivera - Sep 15, 2025, 9:37 AM CDT

Title: Peristaltic Pump Control

Date: 09/15/2025

Content by: Logan Olivera

Goals: Research and figure out a plan to control the peristaltic pump

Content:

Back EMF: When you suddenly stop the current flowing in any solenoid (relay, motor, pump, electromagnet, inductor, aka anything with a coiled wire in it), the magnetic field will collapse and create an opposing current (going the wrong way) with a voltage being many times the original voltage. This is likely to fry any IC despite the very short duration of the voltage spike.

As a general rule, never directly connect any circuit to any inductive load without some kind of protection from back EMF. You can find a <u>much detailed explanation here</u>.\

As per the article, it is critical that the back emf be controlled to not fry our circuit and allow the pump to actually be turned off.

Another important consideration:

<u>Current draw</u>: Also called Inrush current, power-on surge, etc. This is the other reason why you want to use a PWM-based control for your pump. Every electric motor doesn't like two things: starting and stalling. When they do so, they will draw a current that is mostly limited to their (very small) internal resistance.

Its looking like we will use a Arduino to control the peristaltic pump

Source: https://www.instructables.com/Control-peristaltic-pump-with-TA7291P-and-an-Ardui/

Conclusions/action items: Look into an Arduino based circuit to control back emf and start testing (can use oscilliscopes at wendt)

Logan Olivera - Sep 15, 2025, 9:44 AM CDT

Title: Raspberry pi os

Date: 09/15/2025

Content by: Logan Olivera

Goals: Learn about the rasberry pi os and how we can develop on there.

Content:

This is quite similar to a linux based operating system which is nice.

We can get ssh access setup which then will allow me to send files over easily.

Will use the GPIO pins to send and recive signals (probably only need to send a 3.3 or 5v signal depending on what the board will have (depends on which we get).

Can jsut use GPIO package in any and software and control teh pins.

Source: https://en.wikipedia.org/wiki/Raspberry_Pi_OS

https://projects.raspberrypi.org/en/projects/physical-computing/2

Conclusions/action items:

Logan Olivera - Sep 15, 2025, 10:25 AM CDT

Title: Touchscreen options research

Date: 09/15/2025

Content by: Logan Olivera

Goals: Learn about commercially available touchscreen devices and figure out which we would like to use.

Content:

https://www.sparkfun.com/raspberry-pi-touch-display-2-5-portrait.html?utm_source=chatgpt.com

The link above seems like a great simple touchscreen for prototyping. Eventually will upgrade to a more rugged touchscreen that can be used with primates.

Specs:

- 7" Touchscreen Display.
- Screen Dimensions: 194mm x 110mm x 20mm (including standoffs)
- Viewable screen size: 155mm x 86mm
- 70 degree viewing angle
- Screen Resolution 800 x 480 pixels @ 60fps
- · 24-bit color
- 10 finger capacitive touch.
- Connects to the Raspberry Pi board using a ribbon cable connected to the DSI port.
- Adapter board is used to power the display and convert the parallel signals from the display to the serial (DSI) port on the Raspberry Pi.

Only need raspberry pi to power which will be very convenient.

Will want to use raspberry pi imager to install os onto the computer (raspberry pi).

Conclusions/action items: Purchase raspberry pi and begin prototyping and design process.

2025/09/16-Flyback Diode Considerations

Logan Olivera - Sep 16, 2025, 8:41 AM CDT

Title: Flyback Diode Considerations

Date: 09/16/2025

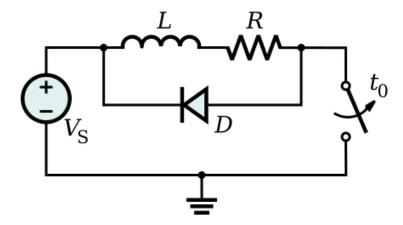
Content by: Logan Olivera

Goals: Know why and when to use the flyback diode in our system

Content:

One big consideration in our project is that when the motor for the peristaltic pump is shut off, there will be a rapid collapse in the magnetic field in the solenoid controlling the motor. This is very important to know as a "back EMF" will be generated. This is a current/voltage in the opposing direction which can be very harmful to the microcontroller and circuitry.

Connect diode in parallel with motor



This can be controlled with a component called a flyback diode.

We can calculate the time it needs to switch off by determining for which t it is I(t) = 0.

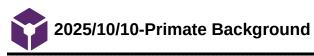
$$t = rac{-L}{R_1} \cdot lnigg(rac{V_D}{V_D + I_0 R_1}igg)$$

If
$$V_{\rm CC} = I_0 R_1$$
, then

$$t = rac{-L}{R_1} \cdot ln \Biggl(rac{1}{rac{V_{CC}}{V_D} + 1}\Biggr) = rac{L}{R_1} \cdot ln \Bigl(rac{V_{CC}}{V_D} + 1\Bigr)$$

Source: https://en.wikipedia.org/wiki/Flyback_diode

Conclusions/action items: Begin prototyping the system and buy the components to do so.



Logan Olivera - Oct 10, 2025, 3:28 AM CDT

Title:	
Date:	
Content by:	
Present:	
Goals:	
Content:	
Conclusions/action items:	



Logan Olivera - Sep 08, 2025, 8:25 AM CDT

https://www.sparkfun.com/raspberry-pi-lcd-7-touchscreen.html?src=raspberrypi - Rasberry Pi Touchscreen

 $\underline{https://en.wikipedia.org/wiki/Transistor\%E2\%80\%93transistor\underline{logic} - TTL\ Logic\ understanding}$

https://en.wikipedia.org/wiki/Rhesus_macaque - Animal to be focused around

Logan Olivera - Sep 15, 2025, 10:32 AM CDT

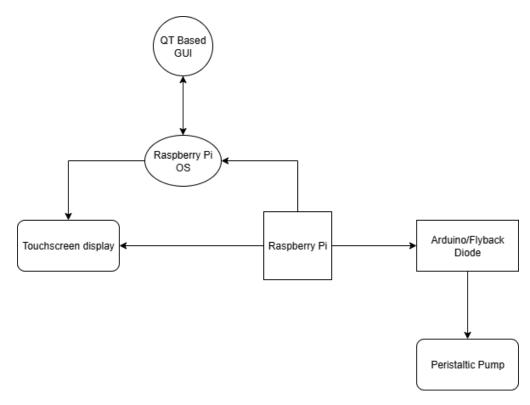
Title: General Project Diagram

Date: 09/15/2025

Content by: Logan Olivera

Goals: Document Diagram

Content:



Conclusions/action items:

Logan Olivera - Sep 26, 2025, 4:07 PM CDT

Title: Raspberry pi layout

Date: 2025

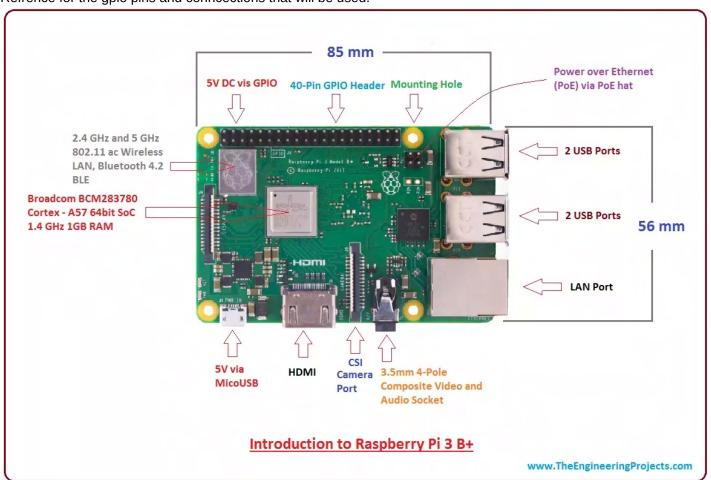
Content by:

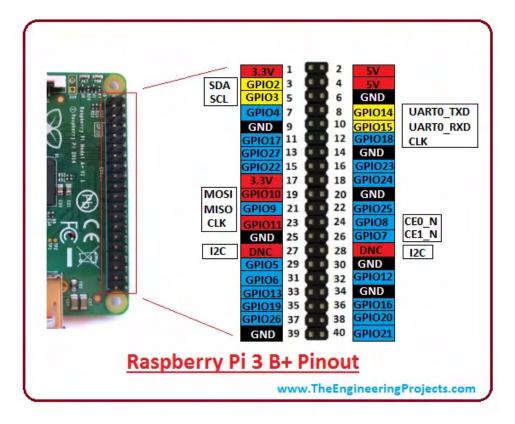
Present:

Goals:

Content:

Refrence for the gpio pins and conncections that will be used.





40 Pin header is used to develop an external connection with the electronic device. This is the same as the previous versions, making it compatible with all the devices where older versions can be used.

Out of 40 pins, 26 are used as a digital I/O pins and 9 of the remaining 14 pins are termed as dedicated I/O pins which indicate they don't come with alternative function.

Pin 3 and 5 comes with an onboard pull up resistor which 1.8 kO and Pin 27 and 28 are dedicated to ID EEPROM. In B+ model the GPIO header is slightly repositioned to allow more space for the additional mounting hole. The devices that are compatible with the B model may work with the B+ version; however, they may not sit identically to the previous version.

Conclusions/action items:

Logan Olivera - Oct 01, 2025, 1:39 PM CDT

Title: Motor controller to be used
Date:
Content by:
Present:
Goals:
Content:
Needs to be able to take in 5v or 3.3v input and send 24 volt output to motor. Should have feedback resistance from back emf.

https://www.hiletgo.com/ProductDetail/1958385.html

Product Name: HiLetgo Motor Driver Module Electrical Distribution Converter

Product ID: 702949574993 Product ID Type: upc Brand: HiLetgo

Manufacturer: HiLetgo

Category (item-type): motor-speed-controllers

Instruction:

This driver uses Infineon chips BTS7960 composed of high-power drive full H-bridge driver module with thermal over-current protection. Double BTS7960 H-bridge driver circuit, with a strong drive and braking, effectively isolating the microcontroller and motor driver! High-current 43A.

Electrical performance:

Model: IBT-2

Input voltage: 6V-27V Maximum current: 43A Input level: 3.3-5V

Control method: PWM or level

Duty cycle: 0-100%

Input port:

1.RPWM: forward level or PWM signal input, active high 2.LPWM: Reverse level or PWM signal input, active high

3.R_EN: forward drive enable input, high-level enable, low level off 4.L_EN: Reverse drive enable input, high-level enable, low level off

5.R_IS: forward drive current alarm output 6.L_IS: Reverse drive current alarm output

7.VCC: +5 V power output, 5V power supply connection with the microcontroller

8.GND: signal common low end

this IBT-2 (BTS7960) wants **6–27 V motor power** and simple **3.3–5 V logic**. Here's a clean, Pi-friendly pin plan and a ready-to-run template.

Wiring (Raspberry Pi → IBT-2)

- RPWM → GPIO 18 (hardware PWM)
- **LPWM** → GPIO **19** (hardware PWM) (or 13 if you prefer)
- R EN → GPIO 23
- L EN → GPIO 24
- **R_IS** → GPIO **25** (input, optional)
- L_IS → GPIO 8 (input, optional)
- VCC (5V logic) → Pi 5V (power to the driver's logic; do not power the Pi from this)
- **GND** → Pi **GND** (common ground is mandatory)

Motor power side:

- **B+ / Vmotor** → your 6–27 V supply (+)
- B- / GND → your motor supply ground (tie this ground to Pi GND)
- M+ / M- → your DC motor terminals

Note: Some listings label VCC as "5V output." Treat it as the **5V logic supply pin** for the board's input/isolator side. **Do not** feed your Pi from it.

Control logic you'll use

- Enable: set both R_EN and L_EN HIGH to allow drive.
- Direction & speed (active-high inputs):

```
    Forward: RPWM = PWM(duty), LPWM = 0
    Reverse: LPWM = PWM(duty), RPWM = 0
    Coast (free-run): RPWM = 0, LPWM = 0
    Brake (active brake): RPWM = 100%, LPWM = 100% (briefly; watch current/heat)
```

• Fault/overcurrent: R_IS / L_IS go active on fault (polarity varies by board; treat as inputs and print when they change).

Python (RPi.GPIO)



Logan Olivera - Sep 26, 2025, 1:23 PM CDT

Title:	
Date:	
Content by:	
Present:	
Goals:	
Content:	

A300BX-S | OEM Peristaltic Pump | USB Serial Control | 24V Brushless DC | Models to 1700 mL/min



SPECIFICATIONS

Pump Series A301BX-S | A302BX-S
Tubing Class Performance | Premium
Motor Type Brushless DC (42mm)

Operating Voltage 8V to 26V
Max Current 1.5A

Duty Cycle Continuous

Est. Motor Life 5,000+ Hours

Max. Outlet Pressure 25 psi

MATERIALS OF CONSTRUCTION

Pump Head Polycarbonate

Roller Material MoS2 Filled Nylon

Rotor Material Powdered Metal

Logan Olivera - Oct 01, 2025, 1:49 PM CDT

Title: Consider which pins need to be used/acticvated
Date:
Content by:
Present:
Goals:
Content:
https://electronics.stackexchange.com/questions/87103/why-is-pwm-used-to-control-dc-motor-speed-instead-of-using-a-variable-resistance
• R_EN / L_EN (enables): "Wake up" the right/left half-bridge driver. Keep both HIGH to allow motion. Pull

• RPWM / LPWM (inputs): These command how hard each half-bridge drives. You send PWM to one of

PWM on RPWM, LPWM=0 → one direction

them **LOW** to shut that side off (safety/disable).

them at a time to set speed and direction.

- PWM on LPWM, RPWM=0 → opposite direction
- Both 0 → coast (free-wheel)
- Both driven together → active brake (stops fast)

So using **all four** gives you:

- A positive/negative speed command (by picking which PWM line you drive),
- Optional fast braking (drive both together),
- A quick kill switch (drop EN).

I should set up all 4 pins for full contorll and understanding of what the pump will do.

Logan Olivera - Nov 24, 2025, 1:01 PM CST



Download

citiCompletionReport_15009519_73131447_1_.pdf (78.6 kB)

Logan Olivera - Nov 24, 2025, 1:01 PM CST



Download

Screenshot_2025-10-31_172125.png (151 kB)

Logan Olivera - Sep 10, 2025, 1:40 PM CDT

Title: Lecture #1

Date: 09/10/25

Content by: Logan Olivera

Present: BME Lecture

Goals: Note on job searching lecture

Content:

Lecturers: Dr. Puccinelli and Stephanie Kann

Job search tips:

ECS.wisc.edu there is a resources page with a job tracker. Only should apply through real sites.

When applying, connect with a person so you can follow up with that specific person. \

Resume Tips:

Tailor the resume to the specific position you are looking for, keep it high level. Needs to be flawless, no errors or mistakes anywhere, can lose you a job. Relevant information is very useful as will increase odds. Resume is always under construction. Is good to keep updating it time after time as to update employers.

Do not need a cover letter for the career fair.

A good cover letter is a place to share more information about the applicants experience. Can tailor the cover letter to a specific job to show why they are a good fit for that position.

Good to make connections at the career fair if needed.

Logan Olivera - Sep 17, 2025, 2:00 PM CDT

Title: Lecture #2
Date: 09/17/25
Content by: Logan Olivera
Present: BME Lecture
Goals: Leadership styles
Content:
Started with fire alarm :)
Main topics to hit
1 defining leadership
2 styles
3 connect
4 goal setting
Discussed important qualities of an effective leader.
Check cliftonstrength report to learn about team dynamics and how people will work together well
Styles:
Power
Servant
Authentic
Goal Setting:
My goal for this semester is to split work better rather than just try and do everything. I have had this issue in the past and end up sacrificing my health and sleep to get the project done. This could be avoided just by splitting the work better throughout my group.

To me success looks like completing our project well without minimal stress and overworking throughout our group.

well. I also plan on making sure no one has too little or too much work, finding a good balance.

I will try and practice this by assigning tasks to people much earlier in time and checking in to see if the tasks are going

Logan Olivera - Sep 24, 2025, 1:49 PM CDT

Title: Lecture #2

Date: 09/24/25

Content by: Logan Olivera

Present: BME Lecture

Goals: Peer Mentoring

Content:

We are mentoring our bme 200 students to learn how to lead a team and bring people along with something that you are an expert in. Be able to relate and guide the 200 students as well. Can be attributed to career development as well in the sense we are training others to complete tasks.

There are many benifits to mentoring.

Good Mentor characteristics:

- someone who can take critisim
- someone who has a good plan laid out
- someone who is willing to adapt to the mentees needs

-

In my 200 experience I wish I had a better understanding of the layout of the course as well as what is coming up in the schedule. It felt at times projects were just launched at me without warning. I learned a quite a bit of information when it comes to resources the class offers of which I plan to use in bme 300 to mentor the 200's.

Logan Olivera - Oct 01, 2025, 1:44 PM CDT

Title: Lecture #2

Date: 10/1/25

Content by: Logan Olivera

Present: BME Lecture

Goals: Peer Mentoring

Content:

Discussing sustainability and resources we use. Big topics in this lecture are what materials we use and how we try and use materials that will not be harmful for the environment.

One way we can learn about the sustainability of differing devices and resources is a lifetime assessment of the product.

It is important to consider all of the health impacts, enviornmental and other impacts and resources/products can cause.

We can use carbon dioxide equivalents to compare different types of envoirmental issues.

Where do we want to go in the future for engineering a sustainable world?

Logan Olivera - Oct 08, 2025, 1:48 PM CDT

Title: Lecture #2

Date: 10/8/25

Content by: Logan Olivera

Present: BME Lecture

Goals: WARF Lecture

Content:

WARF is a non profit on campus focused on inventions and supporting inventors at uw madison and through research funding. They can be very useful for consulting, research, advice, sponserships, funding and more.

They are most invloved when it comes to something that can be patentable. Their main focus is intellectual property such as patents, copyrights, trademards and trade secrets.

A patent is property rights.

WARF gains ownership of the pant if it goes through them. Saves hassle of doing the work yourself but also lose rights. they got roughly 400 inovationd disclousres a year.

Logan Olivera - Oct 22, 2025, 1:41 PM CDT

Title: Lecture 7
Date: 10/22/25
Content by: Logan Olivera
Present: n/a
Goals: Addend lecture and complete and required activities.
Content:
Topic of lecture: Post Graduate Planning
Undergraduate is a great time to "build a story" as you can get experience after experience very easily.
Research is great opportunity in undergraduate.
Good to have 3 good references. Potentially prepare for GRE depending on grad school. When writing my story, make sure it is clear to the reader and not just the writer.
sure it is clear to the reader and not just the writer.
Taylor personal statements to specific institutions.
Conclusions/action items:

Logan Olivera - Nov 05, 2025, 1:55 PM CST

Title: Lecture 7

Date: 11/5/25

Content by: Logan Olivera

Present: n/a

Goals Learn about regulations behind biomedical applications

Content:

A big aspect of most industry is regulations and FDA approval for biomedical devices. Main approvals are 510(k) PMA - for devices, NDA and IND with drugs and BLA and IND for biologics.

The FDA follows the main us laws, then U.S. regulations then has their own guidelines.

It is very important to classify what products do as it can very the requirements it has to meet heavily. A lot of companies and places try to market their products to the FDA as lower classifications for easier approval.

When discussing a product, it is looking at a discussion of risks and safety concerns for a patient and how that may affect them.

Rigorous tests to the product being used on a human must be done to ENSURE nothing wrong can go wrong.

Logan Olivera - Nov 07, 2025, 12:37 PM CST

Title: Tong Lecture

Date: 11/07/25

Content by: Logan Olivera

Goals: Take away what I can from tong lecture

Content:

Lecture looking over the business side of the industry world. Pandemic took over the a lot of the IBGYN industry.

US spends 18 percent of gpd on healthcare but compared to other countries we lack in many major fields. Healthcare as it stands it quite broken in the united states.

Logan Olivera - Nov 19, 2025, 1:41 PM CST

Title: Product Development in Medical Device Industry

Date: 11/19/2025

Content by: Logan Olivera

Goals: Learn about product development in the medical industry

Content:

Speaker Russ Johnson

- Studied as a biomedical engineer and received a PhD in material science at Clemson

For product development, it can be very expensive in the medical industry. This can be due to fda regulations and other resource intensive aspects.

Usually a business will layout a business strategy for the next few (3-5) years.

Stage-Gate Process

Stage 0 - Ideation

Stage 1 - Exploration

Stage 2 - Concept Development

Stage 3 - Design Development (actually create design)

Stage 4 - Design Conformation (FDA approval and make sure it works)

Stage 5 - Design transfer and commercialization.

KALOB KIMMEL - Sep 09, 2025, 9:46 PM CDT

Title: Allentown Cage

Date: 9/9/25

Content by: Kalob

Present: Kalob

Goals: Learn about the dimensions and other specifications of the cage the monkeys are housed in

Source:

[1] "Primate Housing - Allentown," Allentowninc.com, 2019. https://www.allentowninc.com/large-animal-housing/primate/

Content:

The cages can be configured in many different ways. The main configuration that our client said they use the two over two configuration. The cages are very customizable. The types of side pannels are: Solid, Grid, Interactive solid, and Interactive grid. There are three types of pan,s which are plastic, stainless steel, and rear partial flush. Center dividers can either be stainless steel or lexan. The way that the cage is cleaned is through an autoclave, so the screen and device have to be easily detachable. There are no specifications on the website about bar spacing so we will have to measure that at wimr. Overall, it seems that the cage is very durable and customizable. The cage itself is 6ft^2 or 4.3ft^2, depending on what cage our client has, and then the will also be multiplied by 4 because our client configures the cages like the photo below.



Conclusions/action items:

We need to measure the bar length so that we can think of how we want to attach the touchscreen in a way that is easy to take off for autoclaving, while also being monkey proof. The cage itself is very customizable so it should be pretty easy to work around.

KALOB KIMMEL - Sep 26, 2025, 3:27 PM CDT

Title: Aluminum Research

Date: 9/26/25

Content by: Kalob

Present: Kalob

Goals: learn about aluminum as a prototyping material

Source: https://us.arrk.com/aluminum-rapid-prototyping-precision-in-product-development/#:~:text=There%20are%20several%20techniques%20used,of%20cost%20efficiency%20and%20scalability.

Content: Aluminum is great for rapid prototyping for projects that demand high strength! It is a conductor which is something we may need to look into managing. It is really good for the cnc, mill and lathe. It can also be used in urethane casting. There is also special functions we could use such as 3D printing, but this is still hard with scaling and cost. One other reason it is good is how light it is compared to other metals. Overall it meets a wide range of needs, making it compatible with a lot of prototyping.

Conclusions/action items:

Aluminum would be a good prototyping material for the case. We may have to worry about insolating it, but that is a final design worry.



10/10/25 Push button, crutch mechanism

10/10/25

By Kalob

source https://www.resna.org/sites/default/files/legacy/conference/proceedings/2009/SDC2009/Jefferds.html#:~:text=The%20height%20adjustability%20off

Content - This article talks about how the crutch mechanism works to lower the crutch. It uses buttons with springs. When you push the button in the spring allows for height to be adjusted. Once the button stops being pushed the spring pushes the button back into place where the barrier then stops from extens



Conclusion- This design could work very well for our doors. I will have to look into how possible it is to insert this in the doors, or if I will have to design a sn

KALOB KIMMEL - Oct 10, 2025, 6:52 PM CDT

Title: Magnetic Contact sensor

Date: 10/10/25

Content by: Kalob

Present: Kalob

Goals: Learn about types of magnetic contact sensors and a little about how they work

Source: magnetic contact sensors | McMaster-Carr

Content: Basically how they work is they have a two magnets, and when they have contact they are able to have the signal sent that everything is okay because the magnets have the magnetic field all good. When there is an opening, the field is broken, and this then sends a signal that the door has been opened. This would be an easy implementation to our project in order to help prevent fail safes! I will put a few options and images below to help visualize!



Conclusions/action items:

Overall, not too expensive around 20-30\$, so it would be a good safety implementation!

10/23/25 How to do a drop test solidworks

KALOB KIMMEL - Oct 23, 2025, 10:52 PM CDT

Title: solidworks drop test

Date: 10/23/25

Content by: Kalob

Present: Kalob

Goals: learn about testing in solidworks

Source: http://youtube.com/watch?v=cyoMtmlIXFM

Content:

Quick summary,

Go to the testing tab in solid works

You can select different tests, I looked into drop test

You can specify drop height, gravity force on which plane

type of gravity

You can also choose how long it takes so how many bounces

It takes a few minues, but then you can get a plot and then as well animate it

This gives you a good idea of where the load distribution is the most.

You could take the numberical values and throw them in matlab!

Conclusions/action items:

I learned this test, but would love to learn more than just the drop test!

KALOB KIMMEL - Dec 01, 2025, 10:40 PM CST

Title: PETG

Date: 12/1/25

Content by: Kalob

Present: Kalob

Goals: Learn about the pros and cons of using PETG

Source:

[1] T. Jackson, "PETG vs PLA: A comprehensive comparison," SUNLU, https://www.sunlu.com/blogs/products-knowledge/pla-vs-petg-a-comprehensive-comparison?

gad_source=1&gad_campaignid=21333751372&gbraid=0AAAAAobnryUYDSxxa9zGmLyPEMj6PPtYM&gclid=CjwKCAiAlrXJBhBA EiwA-5pgwoeQALlvvJmXGUkenj3N-_iWzMSyW4fw5iqGEPSU-111zMlt6l3ldRoCqfcQAvD_BwE (accessed Dec. 1, 2025).

Content:

PETG is more durable than PLA. IT has great layer adhesion which makes it a good fit for a case. It also has a higher melting point making it good for holding electronics that could get hot. It is also amazing at withstanding chemicals and moisture. It is suitable for functional prototypes and even some final products. It is relatively cheap and fairly fast to print.

Conclusions/action items:

PETG is perfect for our product because it will be a functional part that needs to be both chemically and

KALOB KIMMEL - Dec 03, 2025, 7:22 PM CST

Title:

Date: //25

Content by: Kalob

Present: Kalob

Goals: Learn about PLA

Source:

[1] C. V., "All you need to know about PLA for 3D printing," 3Dnatives, https://www.3dnatives.com/en/pla-3d-printing-guide-190820194/ (accessed Dec. 1, 2025).

Content:

PLA was invented 1930. It is semi eco friendly. It is relatively biodegradable. It is heavily used in early prototyping when 3D printing due to its relatively cheap price point with comparably solid strength and printability. Although this is the case it also has its cons. It has a relatively low printing temperature. When compared to other printable materials it is fairly fragile. This makes is good for early rapid prototyping.

Conclusions/action items:

Overall pla is good but for the project we would want stronger material, but great for early prototyping.

KALOB KIMMEL - Sep 18, 2025, 6:20 PM CDT

Title:

Date: 9/18/25

Content by: Kalob

Present: Kalob

Goals: learn the standard size of touchscreens used in studies with monkeys/ any limitations to the material, weight, or finishes.

Source: macaquefoodandwaterrestriction.pdf

Content: The volume of the juice container should be able to hold 80- 100 ml because that is around how much a macaque needs in a day. If undergoing restriction of liquid, it can not be less than 20ml/kg per day. They can not be restricted in water and food at the same time. After looking at a few websites there is no standard size for the touchscreen size, but our client said that our laptop screens would be overkill. The screens are around 16 inches, so somwhere around 10-12 should be interactive enough

Conclusions/action items: The volume should be able to hold at least 80 ml for the juice holder, considering that it will be checked on a daily basis. Screen of 10-12 inches.

KALOB KIMMEL - Dec 09, 2025, 7:32 AM CST

Title: Stress testing in SolidWorks

Date: 12/9/25

Content by: Kalob

Present: Kalob

Goals: Learn how to stress test in solidworks

Source: https://www.youtube.com/watch?v=gBrWNwv5nEw

Content:

This was the video that I watched in order to learn how to stress test in solid works. This was really helpful in showing the stress in areas of the part made. Basically how it works is you run a new study and then do a static test. You can then attach constrains such as fixing to a wall or cage in our case. You can set the material to almost anything you could think of, for our project we looked at aluminum and PETG. From here you can apply the force that you want to apply on whichever face you want. You can then run it as mesh and run the study and you can see where there is deformation, and see where there is red which is plastic deformation. You can see how much deformation happens as well which is good for knowing if that will be a problem in your project.

Conclusions/action items: This was a very helpful video for testing out some of our designs and learning where the stress points are.



KALOB KIMMEL - Dec 09, 2025, 7:42 AM CST

Title: SolidWorks Tutorial

Date: 12/9/25

Content by: Kalob

Present: Kalob

Goals: Learn how to use solidworks

Source: https://www.youtube.com/watch?v=CiBwrjUeB8U

Content: This was the video that gave me a refresher on how to use solid works at the beginning of the semester. It goes over the methods of 2d drawings, shortcuts, where to find everything in menus. This was helpful for changing units. It also reminded me of things like different planes and property managers. Another area where it was helpful was defining the project in solid works. If the parts are overrefined or underdefined they cannot print so it was good to be refreshed on this. The most helpful part of the video was learning how to draw in 3d. This helped me learn how to use different planes in order to create objects that are not overly boxy. This really helped for the clamping case prototype that I made.

Conclusions/action items:

Overall this is a very helpful video that goes over the basics of solidworks and touches on 2d and 3d drawing, rendering, planes and so much more.

KALOB KIMMEL - Dec 09, 2025, 1:35 PM CST

Title: PETG shinkage

Date: 12/9/25

Content by: Kalob

Present: Kalob

Goals: learn how much petg shrinks and how that effects prints.

Source: How Does PETG Shrink Rate Affect Your 3D Printing Projects?

Content:

When 3D printing it is important to know the properties that you are printing with. For our project we printed with PETG. A learning curb with this was that we did not know that it shrinks some when printing. This makes the final print slightly smaller than the dimensions that you use on the solid works. For PETG it is due to the material shirking when it cools after the print material is made malleable to print. There are other factors such as print speed heat etc, but the average rate of shrink is about 0.5% to 1%. This means that you should account for this in the cad if you are using PETG. With the survey done in the article, 65% people found dimensional inaccuracies.

Conclusions/action items: We should make the CAD for the case cavities larger by at least 1% to allow for smooth fitting of the device into the case.

KALOB KIMMEL - Dec 09, 2025, 2:41 PM CST

Title: Stepping down voltage

Date: 12/9/25

Content by: Kalob

Present: Kalob

Goals: learn how to use one power device to supply multiple voltages

Source: https://electronics.stackexchange.com/questions/251213/how-to-provide-power-to-a-device-that-needs-3-

different-input-voltages

https://www.reddit.com/r/AskElectronics/comments/17fsbh7/powering_a_big_project_with_multiple_voltage/

Content: After looking into a few different forms it look like you can use a higher voltage supplier and then step down the current as needed through voltage dividers. It gets complicated though because you may need to supply minimum load to some of converters. To do this you will need the main power supply that is able to power the whole system. With intermediate voltage it becomes the primary voltage bus. Throughout then you need to calculate for needed power, voltage, amperage and place the specialized converters that get you there near the electronic modules.

Conclusions/action items: Overall, this looks dangerous and overly complicated. I think it is the smartest decision for the team just to use a power strip to supply needed power.



KALOB KIMMEL - Dec 09, 2025, 3:07 PM CST

Title: IEC 61010

Date: 12/9/25

Content by: Kalob

Present: Kalob

Goals: Learn about the electrical requirements of IEC61010

Source: https://www.intertek.com/medical/iec-61010/

Content: The following are what I found to be what we need to be aware of with this project. General Safety and Hazard Mitigation: It is required that the design protects the users and the surrounding area from hazards such as electrical or thermal. Risk Assessment: To follow it must go through assessment of all the potential hazards. The ones that we need to be diligent of are Mechanical Hazards such as problems that could be caused by the case in which may be dangerous, and Electrical Hazards such as making sure that no electric can get wet and put anything in danger. Protection from Fluids/Ingress: This is also important for keeping electrics safe, but it needs to make sure no liquids can get in. Resistance to Mechanical Stresses: The device must be able to withstand the forces exerted by the NHP. Such as biting, pulling, striking, etc. that would cause a hazard.

Conclusions/action items: Our case is safe water tight, electrics separate, and the case has a FOS of 2.18 so it is safe and follows the standards.



KALOB KIMMEL - Dec 09, 2025, 3:00 PM CST

Title: Animal Welfare Act

Date: 12/9/25

Content by: Kalob

Present: Kalob

Goals: Learn about the Animal Welfare Act and how it applies to the scope of our project.

Source: https://www.aphis.usda.gov/media/document/17164/file

Content:

The following are ways that I found that the animal welfare act applies to our project. Environmental Enhancement (Psychological Well-being) - This applies because we are automating training in the home environment of the primate. This requires the primates to have mental stimulation, so our project is following this, and also helps with keeping stress levels low. Institutional Animal Care and Use Committee (IACUC) Review. This project would need to be submitted to this committee in order to ensure the animals are safe. Housing and Construction Standards: Because it is placed in the animals enclosure it needs to be within AWA such as cleaning, safe, durable. Attending Veterinarian Oversight: Any exceptions must be overseen by a VET.

Conclusions/action items: Overall our project follows the standards well as supported by our testing. We could go through IACUC if we had more time.



9/9/25 "Training Rhesus Macaques for Venipuncture Using Positive Reinforcement Techniques: A Comparison with Chimpanzees"

KALOB KIMMEL - Sep 09, 2025, 10:11 PM CDT

Title: "Training Rhesus Macaques for Venipuncture Using Positive Reinforcement Techniques: A Comparison with Chimpanzees"

Date: 9/9/25

Content by: Kalob

Present: Kalob

Goals: Learn about current positive reinforcment studies in Rhesus Macaques

Source:

[1]K. Coleman et al., "Training Rhesus Macaques for Venipuncture Using Positive Reinforcement Techniques: A Comparison with Chimpanzees," Journal of the American Association for Laboratory Animal Science: JAALAS, vol. 47, no. 1, p. 37, 2008, Available: https://pmc.ncbi.nlm.nih.gov/articles/PMC2652623/

Content:

Before the study it was thought that chimpanzees and Macaques could not be trained in a similar manner. In this study they trained the Macaques to put their arms in blood sleeves. This was done so that the researches could do in cage venipuncture. The success rate was around 75% where in chimps it was 100% so the study was not fully successful, but using positive reinforcement in the Macaques is a viable option. There were 8 Macaques in the study. The positive reinforcement used was the pink liquid seen below. There was also a secondary reinforcer which one of the researchers was clicking. This was reinforcing the monkey to hold onto a peg with its arm in the sleeve. This allowed for the researcher to draw blood. The training sesions were 5-10 mins 2 to 3 times a week for this desired behavior.



Conclusions/action items:

6/8 of the monkeys were successfully trained. The positive reinforcment was juice and the secondary was clicking. The objective was to have the monkeys grab onto a bar in a sleeve making it possible for the researchers to draw blood.

KALOB KIMMEL - Dec 09, 2025, 7:02 AM CST

Title: Primate training

Date: 12/9/25

Content by: Kalob

Present: Kalob

Goals: Learn more about primate training

Source: http://tandfonline.com/doi/epdf/10.1207/S15327604JAWS0603 03?needAccess=true

Content: This source is good because it goes over a lot of studies and summarizes them. The first study that it goes over takes a look at certain behaviors that they could train. They trained them to come to the front of the cage (2.5 hrs), come to a station (3hrs), touching a target (more than 5 hrs), hold that target (10 hours). The last one was the highest amount of thinking needed. The second study looked at using PRT (positive reinforcement training) to change the amount of time the primates had social interactions. This was in female primates. In this study they trained high affiliators (trained not to affiliate), and low affiliators (trained to affiliate more over 5%). The third study looked at feeding related aggression and PRT. This involved training the primate to sit in one spot wich is not associated with food aggressive primates. This study showed a decline in food aggression, and even showed elimination of additional aggression throughout the day. The study was training of primate voluntary movement. They were trained to come to the inside corral of the enclosure. This resulted with 16.1 training sessions and 22 total attempts as means for reaching compliance. The data also pointed out that females took a lot less time than males.

Conclusions/action items:

Overall this was very insightful, especially the first test. We saw that primates take a long time to learn how to hold a button and it is very hard mentally, but possible with prt!

KALOB KIMMEL - Dec 09, 2025, 7:02 AM CST



Rull Never 6. Continues of accessand users as be found at https://www.tandbinine.com/action/purvain/formation/purvaincom/action/action/purvaincom/action/act

Download

Positive_Reinforcement_Training_As_a_Technique_to_Alter_Nonhuman_Primate_Behavior_Quantitative_Assessments_of_E ffectiveness.pdf (194 kB)

12/9/25 Intelligence of Rhesus Macaque

KALOB KIMMEL - Dec 09, 2025, 7:22 AM CST

Title: Intelligence of Rhesus Macque

Date: 12/9/25

Content by: Kalob

Present: Kalob

Goals: Learn about the strength and intelligence of rhesus macque

Source: https://pmc.ncbi.nlm.nih.gov/articles/PMC5597818/pdf/rspb20162738.pdf

Content: This study looked into social tolerance which is a driver of enhanced cognitive skills. This helps with cooperation, coordination, and communication. The hypothesis was that higher social tolerance would show more skills in social and inhibitory control. The primates that they used all had similar physical cognition. They used 39 primates, and had two groups of tolerants. The tasks tested were physical domain, social domain, and inhibitory control. The results were that there was that the more tolerant group outperformed in the inhibitory control (less tolerant group failed 85% of time). More tolerant were also slightly more socially cognitive and more likely to succeed at pointing at cups tasks, but that was the only one that there was a difference.

Conclusions/action items:

Overall the type of tolerance really effects the inhibitory control of the primates, making them slightly more intelligent if they are more tolerant.

KALOB KIMMEL - Dec 09, 2025, 8:45 AM CST

Title: Overview of Rhesus Macaque

Date: 12/9/25

Content by: Kalob

Present: Kalob

Goals: Learn more about Rhesus Macaque

Source: https://primate.wisc.edu/primate-info-net/pin-factsheets/pin-factsheet-rhesus-macaque/

Content: They can reach weights of 7.7 kgs or right around 17 lbs. Overall they belong to the genus Macaca. They are dusty brown fur with bare faces. They are sexually dimorphic, and the males are larger. They are skilled swimmers. They are quadrupedal and are mostly arboreal or terrestrial depending on habitat. They will live for about 25- 30 years and up to 40 in captivity. They live all throughout the world from Asia to India. The are highly adaptive, and try and coexist with humans often making contact in villages. They are omnivores, and 93% of diet can be attributed to humans. They eat fruits, leaves, seeds, invertebrates, etc. Groups are characterized by female philopatry and male dispersal. Females form strong, stable matrilineal dominance hierarchies. They are the most studied NHP, especially important in biomedical research. They have helped in the development of the polio, rabies, and smallpox vaccines, the discovery of the Rh factor in blood, and advances in managing HIV/AIDS, COVID-19 vaccines, Parkinson's disease, and stem cell research.



Conclusions/action items: Overall they are studied quite a bit. An important part of our project is the force they will put on our device, so if it were to put all its weight on it there would be 17 lbs. That plus our device weight gives a max load of about 20 lbs or 88 N.



12/8/25 Thomas in cage training system

KALOB KIMMEL - Dec 08, 2025, 9:31 PM CST

Title: Thomas in cage training system

Date: 12/8/25

Content by: Kalob

Present: Kalob

Goals: Learn about the Thomas competing design

Source: https://www.thomasrecording.com/np-primate-products-primate-cage

Content: This system uses a phone as the touchscreen. It keeps the phone outside of the cage, so the primate has to reach through the cage in order to interact with the screen. It uses a lever latching mechanism that tightens the case to the cage. This is a very easy way to keep. It is made out of non metallic materials. This makes it possible for wireless recording and stimulations. Overall it is a whole cage, instead of just the system. The walls are transparent, and there is a sliding door which makes it possible to keep the device out of play when it is not needed. The price point is right around 100K so it is quite expensive.



Conclusions/action items:

Overall the device is a full cage with a system, and it uses a really nice latching mechanism. It is really expensive and if we can come in within budget it would be a great improvement of that price point.

KALOB KIMMEL - Dec 08, 2025, 10:40 PM CST

Title: Latching mechanisms

Date: 12/8/25

Content by: Kalob

Present: Kalob

Goals: Learn about different latching mechanisms used on cages.

Source: https://www.kwcages.com/diy/cage-latches-and-springs.html

Content: On this website there are a lot of latching mechanisms that are used to help lock up cages. There are options from springs to locks to just bent medal. Overall I really liked the idea of using springs because they are easy to pull and then put everything into place. There is the possibility of the monkey pushing against it knocking it loose but if we could find a way to combat it, it could be an asset. I also see that they use types of locks together with the mechanisms. They can be broken down into three categories. Latch, spring, and ridged. The latches use locks to lock in place, the springs attach and use spring force and the ridged attach to the cage and just stay.



Conclusions/action items: Overall I think it would be smart to use a combination of these designs to make it very tight and firm but also easy to use.

KALOB KIMMEL - Sep 23, 2025, 9:08 PM CDT



Download

Screen_box_with_door_assem.SLDASM (88.3 kB)

KALOB KIMMEL - Sep 23, 2025, 9:08 PM CDT



Download

door_for_screen_holder.SLDPRT (67.3 kB)

KALOB KIMMEL - Sep 23, 2025, 9:08 PM CDT



Download

Box_part_1.SLDPRT (169 kB)

KALOB KIMMEL - Dec 08, 2025, 2:01 PM CST

This was the first attempt for the cad on the box. It has a door mechanism for getting the screen out easily and dimensions are not correct because we did not have a touchscreen yet. The thought for the doors are so that it can be easily taken out and put back in. There are also holes for cable management.

KALOB KIMMEL - Dec 08, 2025, 2:11 PM CST



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Screenshot_47_.png (196 kB)



9/23/25 Case cad with extra area for pump and nozzle

KALOB KIMMEL - Sep 23, 2025, 10:25 PM CDT



Download

Display_with_juice_pump_holder.SLDASM (100 kB)

KALOB KIMMEL - Sep 23, 2025, 10:25 PM CDT



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door_for_screen_holder_larger_with_wire_hole.SLDPRT (71.3 kB)

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door_for_screen_holder_larger.SLDPRT (63 kB)

KALOB KIMMEL - Sep 23, 2025, 10:25 PM CDT



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door_for_screen_holder.SLDPRT (66.7 kB)

KALOB KIMMEL - Sep 23, 2025, 10:25 PM CDT



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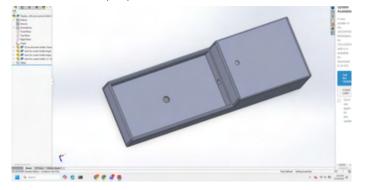
touchscreen_holder_2_base_doorless.SLDPRT (190 kB)

KALOB KIMMEL - Dec 08, 2025, 2:13 PM CST

This was the second idea for the case. It has an extra area for the pump and electronics on the side, and then also doors for easy access. This one took a longer time to make due to the extra compartment and doors required. Overall a really similar design to the first with extra storage.

KALOB KIMMEL - Dec 08, 2025, 2:14 PM CST





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Screenshot_69_.png (388 kB)

KALOB KIMMEL - Sep 26, 2025, 2:43 PM CDT



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Case_with_circut_box_cad_ASS.SLDASM (103 kB)

KALOB KIMMEL - Sep 26, 2025, 2:43 PM CDT



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Part_backing_design_2.SLDPRT (130 kB)

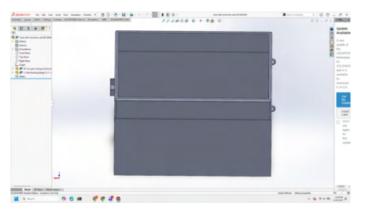
KALOB KIMMEL - Sep 26, 2025, 2:43 PM CDT



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Two_part_casing_touchscreen_holder.SLDPRT (147 kB)

KALOB KIMMEL - Dec 08, 2025, 2:15 PM CST



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Screenshot_74_.png (232 kB)

KALOB KIMMEL - Dec 08, 2025, 2:18 PM CST

This was a brand new take on the case. It would have the touchscreen on the front, and electronics in the back. It would come as two pieces that would latch together with the cage in-between. This was very complex design for the latching mechanism and took a while to figure out. The idea was it would have easy access to everything and keep electronics outside of cage without being too far away.

12/8/25Case with electronics at bottom

KALOB KIMMEL - Dec 08, 2025, 2:20 PM CST



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Final_draft_full_casing_assembly.SLDASM (92.8 kB)

KALOB KIMMEL - Dec 08, 2025, 2:20 PM CST



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Final_draft_door_diplay.SLDPRT (90.7 kB)

KALOB KIMMEL - Dec 08, 2025, 2:20 PM CST



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Final_draft_base_diplay.SLDPRT (231 kB)

KALOB KIMMEL - Dec 08, 2025, 2:21 PM CST

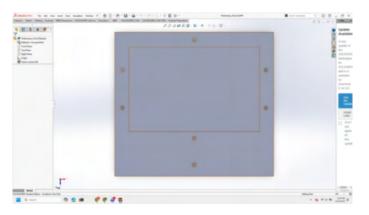


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Screenshot_57_.png (56.9 kB)

This was the front runner for the longest time. It has accessible door that have latching mechanisms, an area available for electronics. The liquid had an accessible area where the primate would be able to easily drink while using the device, and cable management would be fairly easy. The downfall of the design was the possibility for liquid to get through cable management to electronics and we did not want to take that risk. This design took a long time especially while working on the latching mechanism on the doors.

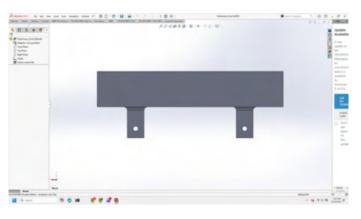
KALOB KIMMEL - Dec 08, 2025, 2:27 PM CST



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Screenshot_72_.png (228 kB)

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Preliminary_Final.SLDPRT (217 kB)

KALOB KIMMEL - Dec 08, 2025, 2:30 PM CST

This is the final design that the team ended up going with. It has a simplicity to its design which made it very good for our client. It has a face plate that gets screwed on and back bars that attach to the cage which also then get screwed on with the latching mechanism. The port for liquid makes it easy for the monkey to do tasks while getting liquid. There is no electronics portion in order to ensure that it is well away from any possible liquids. Overall it is a very safe and easy to use design!

KALOB KIMMEL - Oct 23, 2025, 10:45 PM CDT



<u>Download</u>

citiCompletionReport_15014474_73158297.pdf (78.6 kB)

KALOB KIMMEL - Sep 10, 2025, 1:49 PM CDT

Title: Lecture 1

Date: 9/10/25

Content by: Kalob

Present: Kalob

Goals: learn about jobs/internships

Content: It is important to update your resume for different applications

You don't have to apply only to a perfect resume. Connections get you jobs!

Employers want to see past employment

ECS is open for career fair to help

Cover letter - do not need for the career fair but some will need/ask when applying! This is custom to each application. You can package everything together. 2/3 things you want to get across and supply support!

Advice - Looking for internship, making connections, reconnect with alumni. Look at where program overlaps, for me, mechanical engineering.

Handshake - Filters!

Conclusions/action items: The career fair is important, and it is important to get an internship for experience!

KALOB KIMMEL - Sep 17, 2025, 2:00 PM CDT

Title: Leadership

Date: 9/17/25

Content by: Kalob

Present: Kalob

Goals: learn about leadership

Source: n/a

Content: TAlk about how much of a leader each of us are and the reasons why. Things that people think - communication, empathy, punctuality

anatomy of a good leader - self awarness, vision, empathy, etc.

There are varietys for leadership - personal - self awarness and management compatency goals etc\ interpersonal - recognizing and responding to others needs, active listning etc... /, team - facilitatting team interactions, support others development/, organizational - ceo type stuff more than one team

Clifton strenghts

!

Styles of leadership - Power model - one person in charge

Servant - in service to others and sharing power

Authentic - being genuine/transparent

Goal- have the 200s and 300s feel like they always know what track we need to be on -Create a schedual and check in with everyone to stay on that schedual!

Conclusions/action items:

leadershiip is important, and in group work it will mostly be servant and authentic leadership styles. I think i am good at supporting others!

KALOB KIMMEL - Sep 24, 2025, 2:09 PM CDT

Title: Lecture #

Date: 9/24/25

Content by: Kalob

Present: Kalob

Goals: LEARN ABOUT LEADERSHIP SOME MORE

Content: wHY LEADERSHIP IMPORTANT

A year a go we were little, now we get to lead the 200s

Mentoring builds leadership skills

transferabke skills

mutual benefits

what do I think it means to be a good mentor - Open to questions, soft lead but give leeway, sharing knowledge, open to help in otherways outside bme

-psycological saftey, reliability, enthusiasm, effectivley listen, eye contact

wish I knew to start project earlier, wish I knew more about the design process, wish I had a better schedual

Conclusions/action items:

Leadership is important, so make sure the 200s know their way!

KALOB KIMMEL - Oct 01, 2025, 1:49 PM CDT

Title: Lecture # 4

Date: 10/1/25

Content by: Kalob

Present: Kalob

Goals: Learn about sustainability

Content: there are three pillars of sustain - social, environmental, economic

Coffee and Keurig coffee is about the same environmental impact

Both have issues with microplastics

A lot of doctors offices got rid of paper, bc/ with disinfectant it does not matter

carbon dioxide equivalent - warming equivalent to co2 and this is how we measure impact

also need to think about how to clean tools not just if it is reusable

Conclusions/action items:

Sustainability is complex, you need to think of all of the impacts that come into play. If stuff is used less then you can go with less environmental friendly items, but it becomes better the more you use it to go with longer lasting items.

KALOB KIMMEL - Oct 08, 2025, 1:54 PM CDT

Title: Lecture # 5

Date: 10/8/25

Content by: Kalob

Present: Kalob

Goals: learn about warf

Content:

Warf

Technology transfer - moving research results from campus out into the market. Warf works at this interface to faciliate securing IP rights and commercial licenses

Ex - Intellectual preperty licenses

Four common types of ip - Patents, copyright, trademarks, trade secrets, biomaterial technique/ knowhow, data

copyright - creative expression

trademark - names/logo type stuff

Trade secrets - anything of value - not generally known

Patents - property right granted by government - US patent and trademark - no global - right to exclude people from sell/benefiting off of product

Utility patents - issued fro the invention of a new and useful process machine manufacture or composition of matter - quid pro quo with uspto and the public 2-5 year, cost on average 30K mostly attorney fees

90% of patents issued by uspto are non-provisional utility patents

WARF gets ownership - only use if you want recognition not money

patents need - eligible, novel, non obvous

WARF gets 400 I say it again 400 people work for innovations each year

Conclusions/action items:

I think that warf is good if you do not plan on taking your design further. If you do then I think it would limiting you bottom line!

KALOB KIMMEL - Oct 15, 2025, 1:57 PM CDT

Title: Lecture # Intellectual property

Date: 10/15/25

Content by: Kalob

Present: Kalob

Goals: open my eyes to other careers

Content:

IP is important, and patent litigation is very expensive

have the right types of IP

our innovation can save lives

If you want proper legal advise, you need to go through the proper channels

You have to do a patentability search to see if there is anything the patent infringes on.

Legal paths - technical advisor, patent agent, patent examiner, patent attorney, patent litigator, ip license attorney, Tec transfer manager, engineer

- Skills research, analytical reasoning, technical writing, communication, creativity, collaboration, project management.

disclose internally first publishing before filing and oferes for sale = lost patent rights abroad and possibile loss of rights in the US

posters or abstracts can count as public disclosures

first to file system/ not first to invent

respect other ip

keep invention notebooks

understand inventorship vs authorship

maintain confidentiality

Startups - invent something new, conduct patentability, file patents, nda, file trademarks, form business, obtain business insurance, funding.

Conclusions/action items:

I would prefer to not go down the legal pathway as much as possible so engineer is the best option from what she talked about.

KALOB KIMMEL - Oct 22, 2025, 2:00 PM CDT

Title: Lecture # After college

Date: 10/22/25

Content by: Kalob

Present: Kalob

Goals: learn about options

Content:

Masters program - rewrite your story, make you more desirable to companies, more experience, masters filling the gap year before med school, more mentoring, research thesis, cant find funding for phd, fill holes in resume, dont do masters just to take classes. 3 options - research, accelerated programs, biomed inovation design and entrepreneurship

Explore - MEng, MS in Global Health, SM in other Engineering Dept., MBA

Similar to advice earlier and for PhD programs later

Find faculty/labs performing research/work in, and it is less competitive

PHD - Do your hw and research, network, conferences, utilize lab PI, build resume/CV, external funding

Med school - pre health advising- special requirments - orgo 2 and lab, 2 sem of physics, 2 sem of english,com b, psych 202 and sociology, biochem 501. Research is required, volunteer, shadow physicians, patient contact time, build relationships = letter writers, use design experiences, requirements vary by degree

Make sure to balance everything

Conclusions/action items:

I would like to go straight to industry, but if not I think masters would be good to fill gaps in my resume.

KALOB KIMMEL - Oct 29, 2025, 2:10 PM CDT

Title: Lecture #8

Date: 10/29/25

Content by: Kalob

Present: Kalob

Goals: learn about Regulation FDA

Content:

Devices and biologics are not even close to the same as drugs!

Different classes that show different risks that vary through pathways!

5 10 k clase 2

pma or hdma for class 3

post market surveillance may happen to make sure that no surprises happen.

need more that just reward as an incentive to get it right

There are strengths and weaknesses to all of the testing.

The devices have a lot more than just the body effecting how it works. There are so many different environments!

A device that was not turning on was trying to go to market and the only one that got busted was the CEO

FDA looks at affinitive modes and everything that could go wrong, and then see how you can make those failures not go wrong as often.

Conclusions/action items:

There are a lot of failures and different aspects that you need to take into account outside of what you would normally think. You need to think about those to get approved.

KALOB KIMMEL - Nov 05, 2025, 1:48 PM CST

Title: Lecture #9

Date: 11/5/25

Content by: Kalob

Present: Kalob

Goals: learn about regulatory strategy

Content:

Aspects of regulatory apparatus for therapeutic products

understand the overall structure of the fda including framework of laws regulations and guidance for advanced therapeutics

quality mindset

device: pma 510k,ide

drug: NDA IND

Biologic: BLA IND

laws,regulations,guidance

covid gave FDA more power

any area initially follow broad guidance and then maturity leads to a tighter regulation

ensure potency, pure, novel

each stage of the product development cycle faces its own risks and challenges and proper management of these risks is vital for successful commercialization

important to distinguish on a critical path vs good research projects!

TPP drafted early and living document as it goes

Conclusions/action items:

It is important to create a good guide to your project and stick to it, with that you can make sure you are following guidlines laws and regulations and stay on the critical path.

KALOB KIMMEL - Nov 07, 2025, 12:43 PM CST

Title: Lecture # Tong lecture

Date: //25

Content by: Kalob

Present: Kalob

Goals: Learn about building a career of impact and why healthcare needs more engineers

Content:

Run toward the hard problems they change the world

the three steps - the foundation, the growth, transform

her story - uw madison bme to medtronic to harvard MBA to skyline ventures to arboretum ventures

climb - cheif of staff to ceo at aetna

hoopscotch health - founder ceo | blue cross blue shield - chief operating officer enable access, affordability, outcomes and experience.

don't need to know final destination

we spend 18% gdp on healthcare and 2x per person when compared to other countries

Healthcare system was not designed to be 1 system so it is very jumbled

We need more engineers because the systems are bad for healthcare and it would be good to get new systems which engineers are good at making.

It is important to seek diverse exposure, and choose your people wisely, know your values and protect them, embrace challenge and keep growing

Conclusions/action items:

It is okay not to know where you are going next, but it is important to seek growth along the way!

KALOB KIMMEL - Nov 12, 2025, 1:59 PM CST

Title: Lecture # 10

Date: 11/12/25

Content by: Kalob

Present: Kalob

Goals: learn about the irp

Content: in the past there has been ethical problems

now it is important to make sure that the participant can consent to the research

Important to have respect for the people, beneficence and justice.

Apply belmont principles

IRB composition: Diversity of membership is required - race gender cultural backgrounds, - science expertise and non science.

Risks - no unnecessary risks, appropriate monitoring to prevent adverse effects

benefits - potential direct benefits to participants or scientific benefits

risk benifit ratio, - risks reasonable to relation to potential benefit

equitable selection of subjects

informed consent

privacy and confidentiality

examples of applicable research - drugs devices or products thro research of humans etc.

not research - quality improvement

FDA has a broader definition of human subjects resaerch

HIPAA considerations

examples of non exempt research - surveys of children, analysis of identifiable samples, etc

medical devices - covered in past lecture

IRB successful submissions - answer the questions, dont rush or cut , if you dont agree explain why, IRB is here it help

Conclusions/action items:

IRB reveiws reasearch and you need to make sure that everything is compliant with their guidlines for them to accept your research. Use templates and have a good plan!

KALOB KIMMEL - Nov 19, 2025, 2:05 PM CST

Title: Lecture # 11

Date: 11/19/25

Content by: Kalob

Present: Kalob

Goals:learn about product development in med industry

Content:

Russ johnson

developing products is hard and expensive

have highest probability of success and profit

3 to 5 years out

portfolio review process, project reveiw, budgeting and resource allocation.

line extensions, product improvements, new to company, new to world. Increase in cost and risk

Stage-Gate process: idea, exploration, concept development, design development, verification validation testing, design transfer and commercialization

case study- manual suction canister, automated stryker Neptune

then look for something cleaner and simpler than the Neptune to create to outcompete the competition

look at market trends and ip

brainstorming - themes, storyboards and canvases

transferring does not happen right at the end, it happens somwhat along the process

things like instructions are added and marketing thinks about how to sell it.

class 2 and 3 take note of how the product is doing outside of the testing and actually taking notes of what clients like/dont like, or bad things that happen

Conclusions/action items:

the process of brainstorming, exploration, development, testing, and commercialization is how you put a producing into the medical industry.

2025/09/24 - Strength of Rhesus Mascque Primates

Sameer Bhatt - Sep 26, 2025, 2:55 PM CDT

Title: Strength of Rhesus Mascque Primates

Date: 09/24/2025

Content by: Sameer Bhatt

Goals: Understand how strong the primates can become for our physical design

Link: https://www.jneurosci.org/content/jneuro/42/15/3150.full.pdf

Cited Source: I. S. Glover, D. B. Margetts, and T. L. Davidson, "Both corticospinal and reticulospinal tracts control force in handle-pull tasks in rhesus macaques," *Journal of Neuroscience*, vol. 42, no. 15, pp. 3150-3162, Apr. 2022.

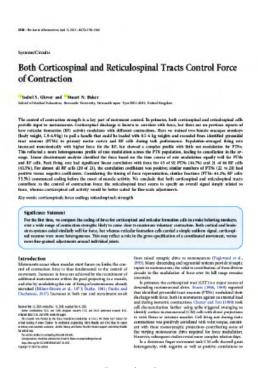
Content:

This specific experiment doesn't truly deal with strength, instead it is a neuroscience experiment however there were some significant aspects of weight training which could be useful for our knowledge. Specifically, the primates typically failed on their first attempt of moving the 5 and 6 kg block, thus we can estimate about a 75-80% percentile of their strength to be around 60-70N of force(6kg * 9.81 m/ 2^2 = 58.1N). At best, their upper bound of strength is most likely close to about 100N or 22 lbs which is significant but not extremely strong. The physical design should account for this and whatever latching/clamping mechanism is decided must be able to withstand at a minimum of ~30 lbs of force.

Conclusions/action items:

30 lbs of force is a solid number to attempt to reach in terms of strength of our design as we have to ensure the primates are not able to move our contraption at all.

Sameer Bhatt - Sep 26, 2025, 2:53 PM CDT



3150.full.pdf (4.23 MB)

2025/09/19 - Raspberry Pi Touch Display

Sameer Bhatt - Sep 19, 2025, 3:47 PM CDT

Title: Raspberry Pi Touch Display

Date: 09/19/2025

Content by: Sameer Bhatt

Goals: Understand and evaluate the Raspberry Pi Touch Display

Link: https://datasheets.raspberrypi.com/display/7-inch-display-product-brief.pdf

Cited Sources: Raspberrypi, https://datasheets.raspberrypi.com/display/7-inch-display-product-brief.pdf (accessed Son 19, 2025)

Sep. 19, 2025).

Content:

A Raspberry pi display is a 7" display with 800x480 display resolution.

Pros)

- 1 Is easily compatible with a Raspberry Pi CPU which is the planned motherboard for this project
- 2 Relatively simple wiring and coding which is good for the users of the projecy

Cons)

- 1 Potentially too small for future application, the client may need to program something which needs a bit more space than 7"
- 2 Not waterproof which is a killer to this idea unfortunately, however it does mention some industrial grade touchscreens which could be valuable
- 3 Also the surface is very fragile which is again not something we can have for this project.

Conclusions/action items:

Although it seemed promising, this display will definitely not work for our application. Industrial grade raspberry pi displays were mentioned which should be looked into.

Sameer Bhatt - Sep 19, 2025, 3:47 PM CDT





Download

7-inch-display-product-brief.pdf (176 kB)

2025/09/19 - Raspberry Pi Panel PC

Sameer Bhatt - Sep 19, 2025, 3:56 PM CDT

Title: Raspberry Pi Panel PC

Date: 09/19/2025

Content by: Sameer Bhatt

Goals: Understand and evaluate the Raspberry Pi Panel PC

Link: https://www.industrialshields.com/shop/touchberry-pi-panel-pc-10-1-9474#
9474#attr=7442,7420,6672,6652,6661,6670,7561

Cited Sources: "TouchBerry Pi Panel PC 10.1"," *Arduino based PLC Controller for Industrial Applications by Industrial Shields*, 2025. https://www.industrialshields.com/shop/touchberry-pi-panel-pc-10-1-9474#attr=7442 (accessed Sep. 19, 2025).

Content:

TouchBerry Pi Panel is a 10" touchscreen which comes with a preinstalled raspberry pi and linux OS.

Pros)

- 1 Preinstalled raspberry pi and OS means all we would have to do is create the game and an attachment to the pump
- 2 IP65 rating which is extremely durable and waterproof meaning the monkeys won't be able to do any crazy harm to the device
- 3 8 Gb microsd storage slot which could be amazing for keeping the data from the experiments
- 4 Has I/O pins for the pump as well

Cons)

1 - It is 595 euros which is around \$700, probably too expensive.

Conclusions/action items:

Overall definitely and amazing product but probably overkill for what we need. IP65 is a rating we should look into for other touchscreens along with storage for the data. Compatibility shouldn't be an issue as we can figure out how to power something with the raspberry pi.

Sameer Bhatt - Sep 19, 2025, 4:22 PM CDT





Download

TouchBerry_Pi_Panel_PC_10.1____Arduino_based_PLC_Controller_for_Industrial_Applications_by_Industrial_Shields.pdf (1.86 MB)

2025/09/26 - Greentouch 8" Touchscreen

Sameer Bhatt - Sep 26, 2025, 4:05 PM CDT

Title: Greentouch 8" Touchscreen

Date: 09/26/2025

Content by: Sameer Bhatt

Goals: Evaluate the Greentouch screen to see if it is viable for the project

Link: https://www.walmart.com/ip/GreenTouch-8-Inch-Open-Frame-1024x600-HDMI-PCAP-Touch-Monitors-for-Consumer-Retail-POS-and-Hospitality-Markets/15594114325?classType=REGULAR

Cited Source:

Content:

The GreenTouch 8 inch touchscreen is an extremely viable touchscreen for our project. It is around \$200 with an IP65 rating which will alleviate concerns about the primates urinating on the screen. In addition, the size seems very optimal for the project as it isn't too large yet not too small either(if size is an issue there are larger versions of the same screen on walmart). Finally, it also has a 3cm thick screen which is impact and scratch resistant which should mean it is ok for the primates to touch the screen as hard as they can. If necessary, we can develop a screen protector as well.



As we can see above, there are also holes around the screen so it could make the machining much easier as well, for example this could simply screw on to the metal machining(Find a drawing of this in my design ideas folder).

Overall, this is most definitely the best touchscreen I have found for this project, as for testing, we should potentially order a cheap ~\$50-70 testing as this may take ~1 month to ship.

Conclusions/action items:

Discuss with the team with touchscreens they have found and decide if this should be used.

Sameer Bhatt - Sep 26, 2025, 2:35 PM CDT

Title: IEC 60601

Date: 09/19/2025

Content by: Sameer Bhatt

Goals: Understand standards that we should attempt to meet

Link: https://compass.astm.org/content-access?contentCode=IEC%7CIEC%2060601-2-24%3A2012%7CBilingual

Cited Source: [1] International Electrotechnical Commission, *IEC* 60601-2-24:2012 – *Medical electrical equipment* – *Part 2-24: Particular requirements for the basic safety and essential performance of infusion pumps and controllers*. Geneva, Switzerland: IEC, 2012.

Content:

IEC 60601 is a fundamental standard relating to medical electrical equipment and it is very useful to follow in a laboratory setting. Specifically, we should be concerned about IEC 60601-2-24 which relates to the basic safety regarding infusion pumps. We will be using something similar to pump juice directly into the primates mouths and thus should meet the standard set out by IEC 60601-2-24. The UW-Madison library didn't have a PDF option unfortunately but I have linked the site which should only require a netID sign on! Below is a summary of the specifications.

- Ensure the pump delivers accurate, consistent flow and alarms when the delivery is outside the acceptable bounds
- Protect against hazards like electrical shock, leakage, etc.
- Accuracy/Performance testing must be done
 - Specifically, flow rate ranges must be defined and met
 - "Trumpet Curves" which is essentially deviation vs. flow rate should be used to assess the flow rates.

Conclusions/action items:

Testing will have to be done for the software aspect of things to pump enough juice out and of course electrical shocks can not happen with the primates, thus these standards shouldn't be hard to meet.



Sameer Bhatt - Oct 23, 2025, 5:05 PM CDT

Title: JHook Latch

Date: 10/16/2025

Content by: Sameer Bhatt

Goals: Shop for potential things the team can buy instead of building ourselves for the latching mechanism

Link: https://www.homedepot.com/p/POWERTEC-375-lbs-Holding-Capacity-J-Hook-Toggle-Clamp-451-w-Hook-Type-Draw-Latch-Pull-Action-4-Pack-20308-P4/321257188?source=shoppingads&locale=en-US

Citation:

Content:



This could attach to the back of the touchscreen case via the 4 screw holes. This would then be able to use the Jhook at the end to attach to the horizontal cage bars, similar to the design idea sketched up in the design ideas folder titled 2025/10/03 - Latch design. As opposed to designing and prototyping an entire latching mechanism ourselves, it could be worthwhile to buy this and create a lock and key mechanism when it is clamped to the horizontal bars to make sure the primate won't be able to unclamp the entire device.

Pros

- Easy to attach
- Withstands 375 lbs of force, much higher than we actually need
- Corrosion resistant against the primate urination
- Relatively cheap ~\$40

Cons

- Small area of contact for the Jhook could lead to some amount of slippage
- Will prevent the case from being flush with the cage, could be extremely difficult to actually clamp the case with this at the back.

Conclusions/action items:

This should definitely be fully considered. Make sure to compare the 3D printed design that the team came up with to simply buying this.

2025/09/26 - Mechanical Design to Hold Up Contraption

Sameer Bhatt - Sep 26, 2025, 1:41 PM CDT

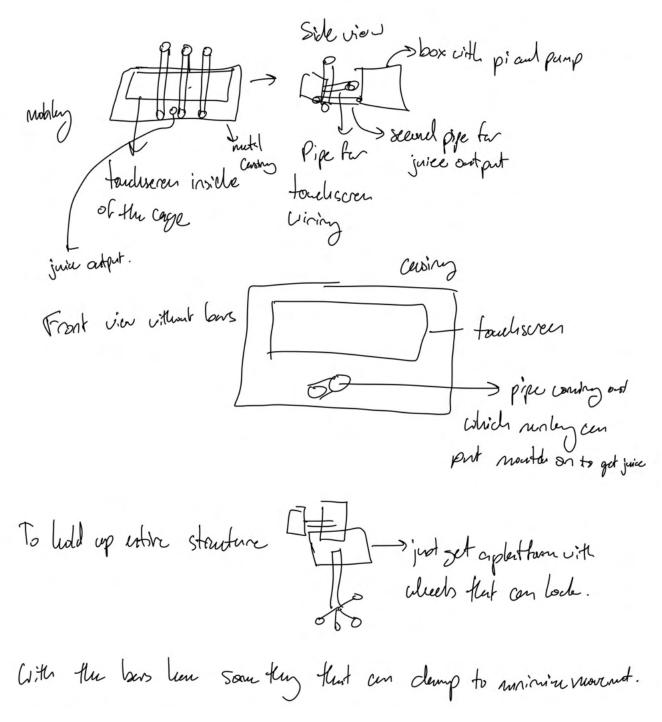
Title: Mechanical Design to Hold Up Contraption

Date: 09/26/2025

Content by: Sameer Bhatt

Goals: Provide a potential mechanical design to hold up the entire contraption

Content:



In essence, we can use some wheel contraption which can lock into place to hold up the back part of the contraption. We will have two pipes running between the two which can help keep the front portion up. Finally, we can develop some sort of clamp/latch with a key to hold the front touchscreen in place to keep the primate from being able to move the touchscreen at all.

Conclusions/action items:

A solid potential design for how to hold the contraption up, will also need to be evaluated in the design matrix.



2025/09/26 - Mechanical Design with GreenTouch Touchscreen

Sameer Bhatt - Sep 26, 2025, 11:39 AM CDT

Title: Mechanical Design with GreenTouch Touchscreen

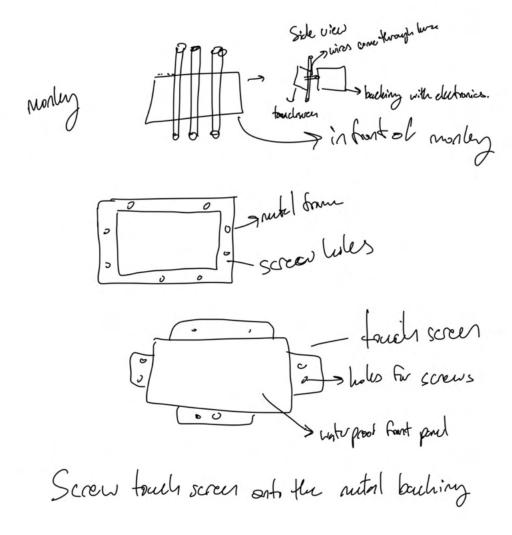
Date: 09/26/2025

Content by: Sameer Bhatt

Goals: Provide a potential mechanical design with the specific touchscreen

Content:

THIS DOES NOT INCLUDE HOW WE WILL ATTACH THE FRAME TO THE BARS, THAT IS IN OTHER FILES IN DESIGN IDEAS!



Sorry for the bad hand writing, but essentially we should have a metal frame with a few screw holes which the touchscreen can screw into. The front panel of the touchscreen is ip65 water resistant which should be very solid. We can add another case if necessary on top of the touchscreen to ensure water resistance but the general idea is to screw the touchscreen in.

Will need to decide whether this is viable or not in the design matrix. Other files will contain how I think we should keep the touchscreen up.

Sameer Bhatt - Dec 10, 2025, 11:28 AM CST

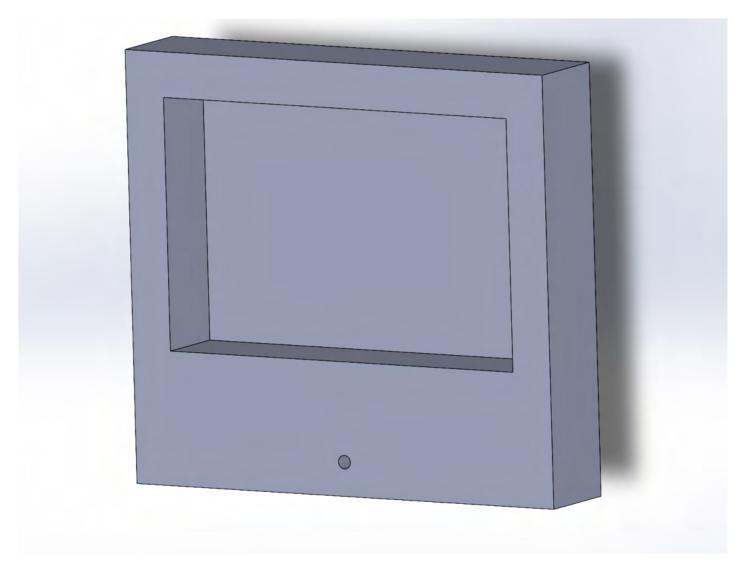
Title: First 3D Printed Design

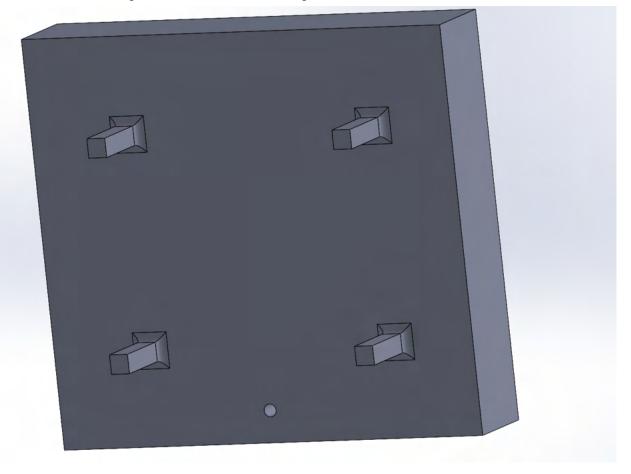
Date: 11/10/2025

Content by: Sameer Bhatt

Goals: 3D print a prototype and see its viability.

Content:





This design is very different than the preliminary final design. The electronics have been moved outside the cage entirely, thus all this cage needs to do is have the screen. From above, one can see that there is a cutout for the touchscreen to fit into the encasing. In addition, there are pegs attached to the back of the encasing to properly attach to the cage. There is also a tube hole at the bottom of the case so that the primate can do the experiment while having the juice squirt into their mouths. After printing, there will be another lab archives entry below this with pictures and things to improve.

Conclusions/action items:

This is by no means a final design but hopefully it should be a working proof of concept.

Sameer Bhatt - Dec 10, 2025, 9:36 PM CST



Download

Preliminary_Final.SLDPRT (200 kB)

Sameer Bhatt - Dec 10, 2025, 9:36 PM CST



Download

Preliminary_Final.STL (47 kB)

2025/11/18 - Final 3D Printed Design

Sameer Bhatt - Dec 10, 2025, 11:20 AM CST

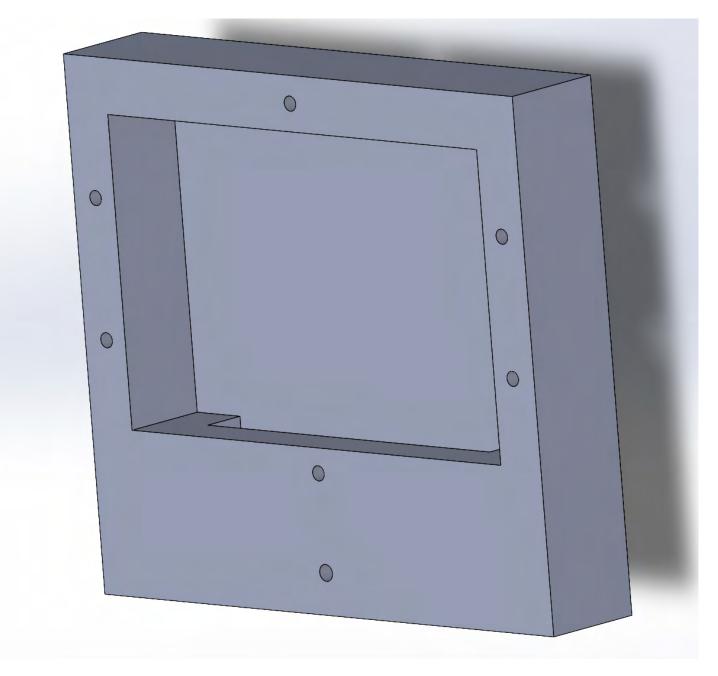
Title: Final 3D Printed Design

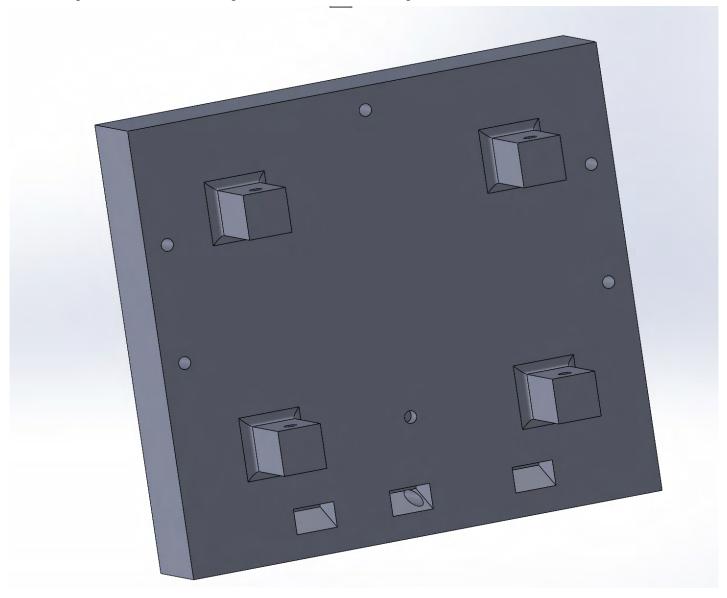
Date: 11/18/2025

Content by: Sameer Bhatt

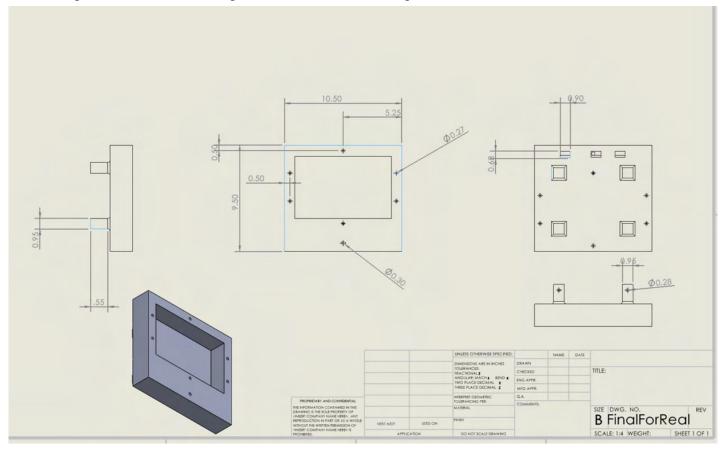
Goals: Develop a final prototype which will be 3D printed

Content:





Above is the CAD for the final design which is going to be 3D printed. A few important features to note are the cable management holes in the back of the design along with pegs to ensure that the latch mechanism(which can be found in latch designs) is effective in latching to the cage. In addition, there are now screw holes to help the front screen attach to the design as well. Finally, the last change from the last design is that there is a cutout below the touchscreen now to help with cable management as well. Below there are some drawings with the important dimensions for this design.



Conclusions/action items:

Overall, this is a very promising design. There will need to be some testing done to ensure that everything fits properly.

Sameer Bhatt - Dec 10, 2025, 9:36 PM CST



Download

FinalForReal.SLDPRT (212 kB)

Sameer Bhatt - Dec 10, 2025, 9:36 PM CST



Download

Preliminary_Final.STL (47 kB)

Sameer Bhatt - Dec 10, 2025, 11:40 AM CST

Title: Front Panel Design

Date: 11/18/2025

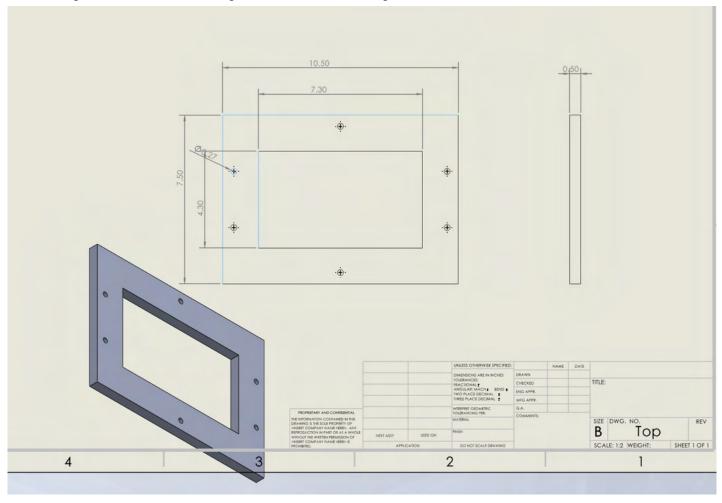
Content by: Sameer Bhatt

Goals: Design a proper front panel to keep the touchscreen inside the enclosure

Content:



The front panel is relatively simple. The outer dimensions perfectly match the enclosure to ensure that aesthetically it looks very solid. The inner dimensions were calculated by using the bevels in the touchscreen/black areas of the screen to ensure that there is actually enough coverage of the front panel on the touchscreen. The hole locations also perfectly match the enclosure. Below the dimensions for the front panel can be found.



Conclusions/action items:

The front panel is not extremely complex so hopefully this should only need to be printed once.

Sameer Bhatt - Dec 10, 2025, 9:37 PM CST



Download

Top.SLDPRT (106 kB)

Sameer Bhatt - Dec 10, 2025, 9:37 PM CST



Download

TopPrimatePortal.STL (57.1 kB)



Sameer Bhatt - Oct 03, 2025, 4:21 PM CDT

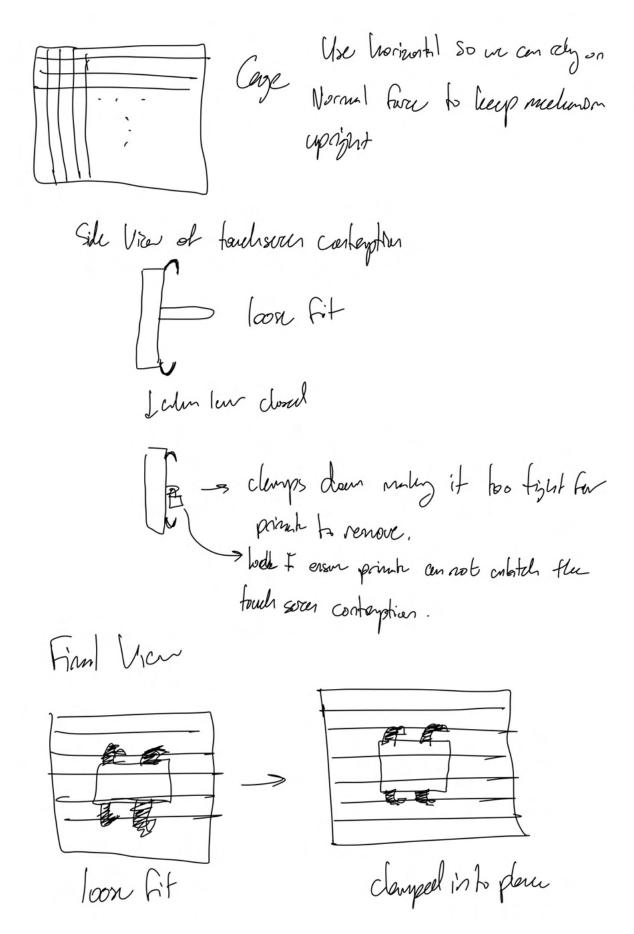
Title: Latch Design

Date: 10/03/2025

Content by: Sameer Bhatt

Goals: Provide a potential mechanical design for the latching mechanism

Content:



To make it easy to put on the hooks have a relaxed position with a lever which is 90 degrees from the back of the touchscreen panel contraption. To lock the touchscreen into place, the lever is rotated 90 degrees to be flush with the

back panel and the hook move down/up to tighten the entire contraption to the horizontal bars of the cage. To ensure the primate isn't able to undo this clamp, there can be a small extrusion with a key hole to make it so the primate can not move the lever and it is still extremely easy for any lab assistant to take on and off the cage. More hooks can be added vertically as well to make it even more secure.

Conclusions/action items:

Currently, this is the best idea that I have thought of however the entire team will need to finalize a latching mechanism.

Sameer Bhatt - Dec 10, 2025, 11:41 AM CST

Title: Old Latch Design Solidworks

Date: 10/16/2025

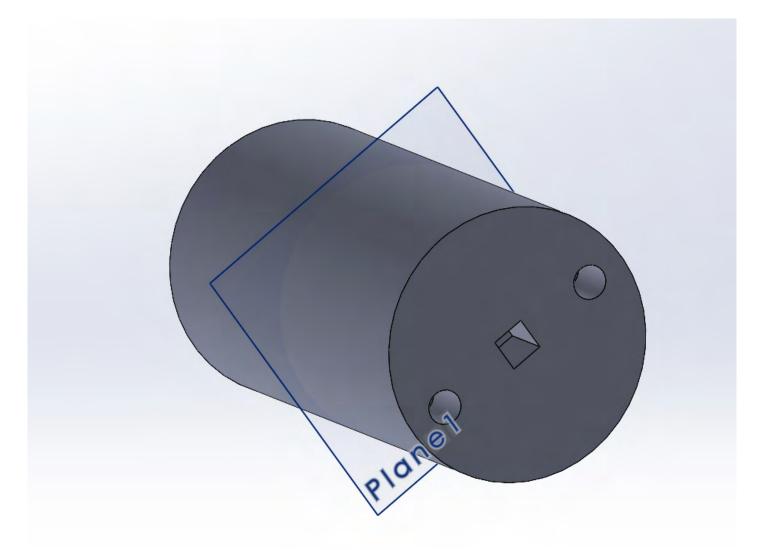
Content by: Sameer Bhatt

Goals:

Content:

Below are screenshots of the different parts for the latching mechanism and the full assembly combining all the parts. While creating the solidworks, there were a few major flaws which were realized and this design has been essentially scrapped for a different one, however this could still have some very solid ideas such as rotating a large piece and locking it in with a lock and key to keep the primate from being able to detach anything.

Piece 1:



Piece 2:

Piece 2 was actually never designed because a better design was thought of before going further with this design.

Conclusions/action items:

It was an ok idea which was scrapped for a better design.



2025/10/23 - Latch Mechanism Going Through the Cage

Sameer Bhatt - Dec 10, 2025, 9:34 PM CST

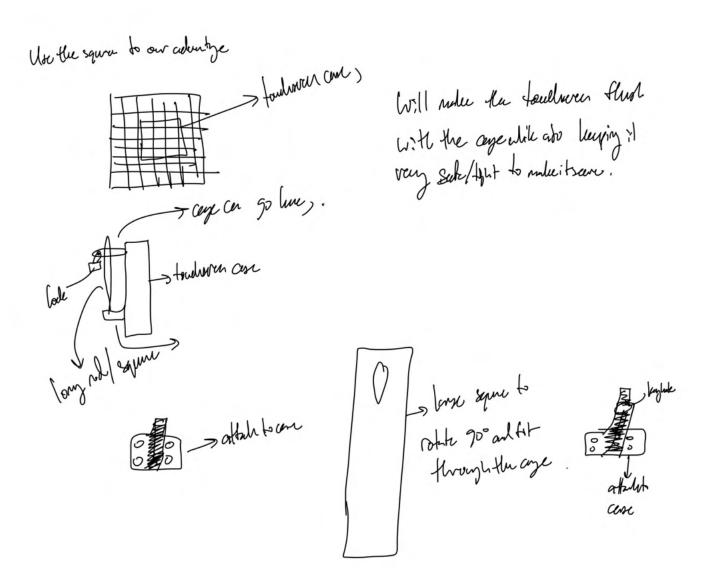
Title: Latch Mechanism Going Through the Cage

Date: 10/23/2025

Content by: Sameer Bhatt

Goals: Sketch a potential design for a latch mechanism which will actually go through the cage

Content:



In this latch design, there will be a square peg and a round peg. The square peg will have a long rectangular shape attached to it via a screw to allow for rotation about the axis along with a hole at the top to allow it to fit into the round peg. As seen in the drawing in the top left, this will span the height of the design and effectively latch the enclosure to

the cage. Finally, the round peg will also have a hole for a lock to fit through to ensure the primate won't be able to unlatch the physical design. Solidworks for this design can be found in a different lab entry for this design.

Conclusions/action items:

This is definitely a better design than the previous idea, should hopefully be solid.

2025/10/24 - CAD for Latch Mechanism

Sameer Bhatt - Oct 24, 2025, 1:57 PM CDT

Title: CAD for Latch Mechanism

Date: 10/24/2025

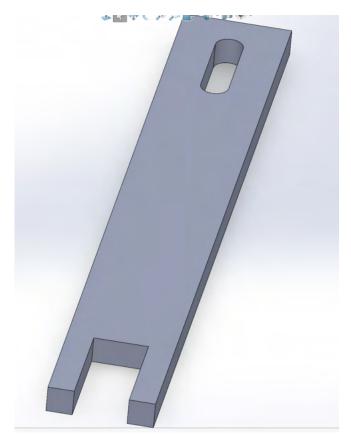
Content by: Sameer Bhatt

Goals: To provide a viable CAD prototype for the new latch mechanism

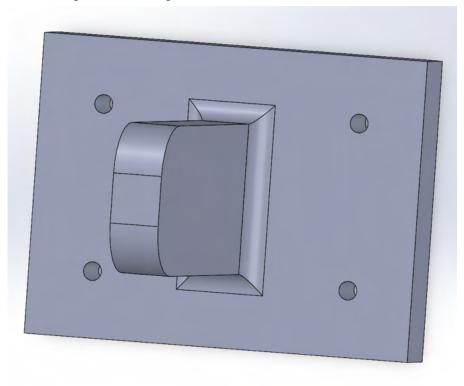
Content:

The solidworks files are attached to the bottom of this entry.

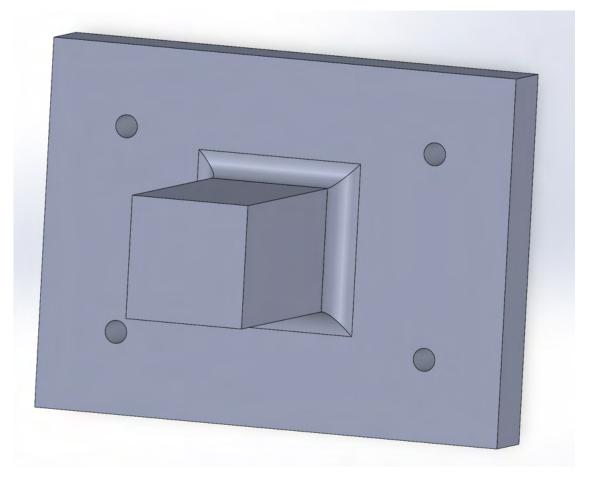
Piece 1: This piece is the backbone of the latch mechanism, the bottom will connect to a piece which is attached to the case and will allow it to rotate about the piece attached to the case. The hole at the other end is where another piece connected to the case can fit through to essentially lock it into place.



Piece 2: This piece will attach to the top of the case. Note, there is no hole in the part which comes out of the base for a keyhole even though there should be, for 3D printing prototyping purposes the keyhole was removed. This piece will slide into the hole from piece 1 and the key will make it so the monkey can not take it off.



Piece 3: This is the final piece which will attach to the bottom of the case. Piece 1 will attach via a screw/nail/rod of sort and will hinge off of the piece which extends off of the base. There are screw holes to help attach to the case.



We are currently 3D printing all of these parts for prototyping. Viability will have to be assessed after it is finished.

Sameer Bhatt - Oct 24, 2025, 1:58 PM CDT



Download

Base_Keyhole.SLDPRT (103 kB)

Sameer Bhatt - Oct 24, 2025, 1:58 PM CDT



Download

Base_No_Keyhole.SLDPRT (95.8 kB)

Sameer Bhatt - Oct 24, 2025, 1:58 PM CDT



Download

Latch.SLDPRT (78.4 kB)

Sameer Bhatt - Dec 10, 2025, 11:48 AM CST

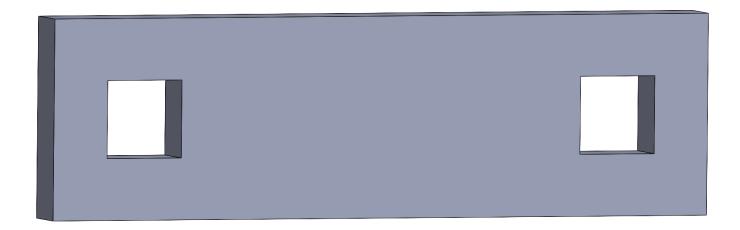
Title: Final Latch Design

Date: 11/10/2025

Content by: Sameer Bhatt

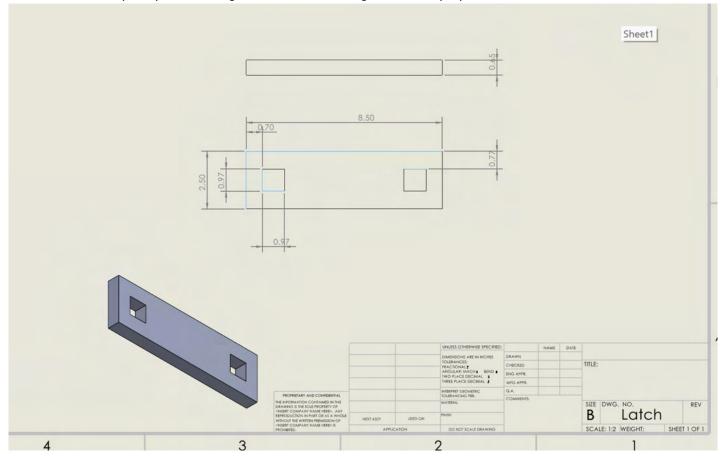
Goals: Hopefully the last latch design

Content:



The latch mechanism has changed with the new 3D printed design. Instead of having a swinging mechanism which would have had to fit through the cage, the client suggested that there should just be pegs and the latch can fit over the cage thus only the pegs have to fit through the cage as opposed to the entire mechanism. There will be screw holes on

the enclosure to help keep the latch tight. Below is a drawing with all the proper dimensions.



Conclusions/action items:

This latch mechanism should be the final one used hopefully, testing will have to be done with the final enclosure when it is done.

Sameer Bhatt - Dec 10, 2025, 9:35 PM CST



Download

Latch.SLDPRT (89.5 kB)

Sameer Bhatt - Dec 10, 2025, 9:35 PM CST



Download

Latch.STL (2.68 kB)

Sameer Bhatt - Dec 10, 2025, 11:55 AM CST

Title: Proposed Future Work Latch

Date: 12/09/2025

Content by: Sameer Bhatt

Goals: Have a proposed different latch design

Content:

At the poster presentations, I noticed a few issues that could be solved with this new latch design. The overall design stays the same with the pegs and the attachment which will attach from outside the cage. To make sure the attachment is tightly fitted to the cage and also has some modularity to potentially work with other cage sizes besides just the one that we created. In essence, all that is added is a bolt to the pegs which faces outwards of the cage. This will go through the square cut outs in the latch attachment and another piece will be printed which has a nut that can screw into that bolt and tighten the attachment on the cage. This would tighten the entire structure better than the current idea would along with helping it be more modular and working with multiple cage sizes. Below is a rough drawing of what this idea is, there is no solidworks as I had this idea right before the semester ended.

Conclusions/action items:

If another team picks up this project this design could definitely be an amazing final latch design.

Title: Fabrication + Attachment Protocol

Date: 12/09/2025

Content by: Sameer Bhatt

Goals: Outline a detailed guide on fabricating the physical design

Content:

Goal

This document should enable any person with sufficient technical ability to fully fabricate the physical design to attach the touchscreen to the cage.

Required Materials and Equipment

- GreenTouch 8" Touchscreen
- 3D Printer
- PETG
- 6 1/4" x 3" screws
- 4 1/4" x 1.25" screws
- 6 1/4" washers
- 10 1/4" nuts
- · Primate Cage

Protocol

- 1. Use a 3D Printer to print all 3 parts of the design(Front Panel, Latch Attachment, Larger Case). An infill of >60% will be necessary with a triangular fill pattern. In a
- 2. Feed the wires through the back of the enclosure and plug them into the touchscreen. Place the touchscreen into the large cavity on the enclosure.
 - 1. Ensure that the touchscreen is close to flush with all of the walls in the encasing, if not, some edits to the dimension of the cavity may need to be done
- 3. Place the front screen on top of the enclosure and make sure the edges are flush with the encasing. It is symmetrical so orientation doesn't matter
- 4. Place the 1/4" x 3" screws through the front panel + enclosure. Tighten the washer and nuts to make sure nothing can detach or break
- 5. Place the enclosure on the cage such that the 4 pegs on the back fit through the holes in the cage
 - 1. Ensure that each peg has contact with the cage, otherwise elements may break off
- 6. Slide the latch attachment pieces into place, with two of them being used horizontally. Screws will be placed at the top to ensure the fit is tight
- $7.\ Analyze\ everything\ which\ has\ been\ attached\ and\ ensure\ nothing\ is\ moving\ or\ loose.$

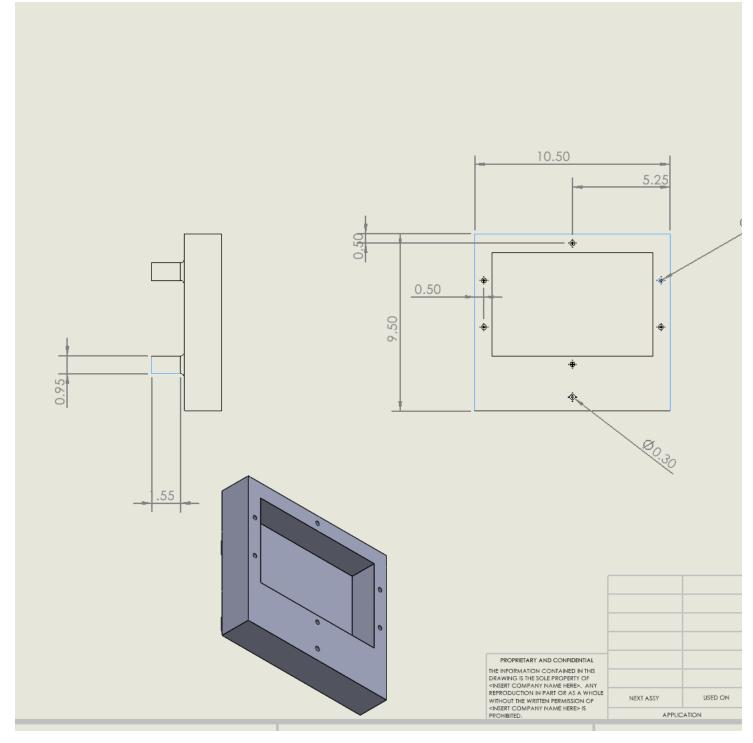


Figure 1. CAD Drawing of Final Design

Conclusions/action items:

This protocol should be able to be followed and the prototype can be built!

2025/12/10 - Required Human Safety Training

Sameer Bhatt - Dec 10, 2025, 12:09 PM CST

Title: Human Subjects Training

Date: 12/09/2025

Content by: Sameer Bhatt

Goals: Complete the necessary training to help understand regulations regarding human subjects

Content:



Completion Date 29-Oct-2025 Expiration Date 29-Oct-2028 Record ID 73299933

Sameer Bhatt

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Basic/Refresher Course - Human Subjects Research

(Curriculum Group)

UW Human Subjects Protections Course

(Course Learner Group)

1 - Level 1

(Stage)

Under requirements set by:

University of Wisconsin - Madison



101 NE 3rd Avenue, Suite 320 Fort Lauderdale, FL 33301 US www.citiprogram.org

Generated on 29-Oct-2025. Verify at www.citiprogram.org/verify/?w7af822c3-b80c-4ec6-8cbe-a392a7d34a22-73299933

Conclusions/action items:

I successfully completed the required training.

Sameer Bhatt/First Client Meeting 173 of 338

Sameer Bhatt - Sep 08, 2025, 1:20 PM CDT

Number 1 Requirement - Must be safe for the animal(ex: can't let them get to electronics, they are smart so make sure system is designed such that failure modes/risks to animal are minimal.

Other requirements - Deliver fluid rewards(juice typically)(they have pumps and need a 5V signal could just use that), track animal input/stimuli,

MVP - some sort of prototype and risk analysis done. Don't necessarily need to attach it to the cage just yet but should have some sort of plan on how to attach. Preferably good documentation with the ability to change the design very easily for new tests for the animal or new cages potentially.

Sameer Bhatt - Sep 10, 2025, 2:00 PM CDT

Title: Job Search Tips/Lecture #1

Date: 09/10/2025

Content by: Sameer Bhatt

Goals: Understand and improve my job search and application ability

Content:

Tips:

- Keep track of what you do
- Quality of source matters
- Connect before you are a candidate
- Applying is step 1 follow up is required
- Think beyond the title

Resume Tips:

- Tailor your resume to the position
- Create balance, show a full picture of your experience
- ATS proofed resume is do-able

Cover Letter:

- Always based on the job posting
- Custom to each job
- Amplifying your greatest selling points

Outline - 1) Intro, 2) Paragraph about experience in A, 3) Paragraph about experience in B, 4) Why this employer

Don't only look for BME internships, have to sell yourself to make sure our names get to all jobs we are certainly qualified for.

Put best foot forward with clothes and stuff.

Sameer Bhatt - Sep 17, 2025, 2:00 PM CDT

Title: Lecture #2

Date: 09/17/2025

Content by: Sameer Bhatt

Goals: Explore my leadership style

Content:

Content for today, 1) defining leadership, 2) styles, 3) connect, and 4) goal setting.

Do I consider myself to be a leader? - Yes

What are important qualities of an effective leader - Communication, Empathy, Good listener, Inclusive, Aura

Anatomy of a good leader - Self-awareness(understand strengths and weaknesses), Vision, Transparent, Communication, Decision-Making, Empathy

Styles of leadership - Thought process "Someone has to take control", defining qualities, and having a heirarchy

Authentic leadership - Transparency, genuineness, and honesty

Servant - empathetic, empowering, shared decision making

Power - Hierarchy, authority, command

Goal setting - I want to ensure that the sophomores in BME 200 feel included and are able to do the work they want to do. The way to practice the coaching and mentoring skill is to make sure to listen and learn from the sophomores as much as they do from us to ensure we understand what they want to do. Success would be pretty simple but it would look like everyone on the team being happy with what they did for the project.

Sameer Bhatt - Sep 24, 2025, 1:55 PM CDT

Title: Lecture #3

Date: 09/24/2025

Content by: Sameer Bhatt

Goals: Learn how to peer mentor

Content:

Why am I mentoring BME 200 students? - They are very new to the entire BME design process so to make sure they don't get overloaded with info and too much work I'm here to help answer any questions they have as opposed to them just being confused the entire time. In addition it helps us gain some leadership skills.

What does it mean to be a good mentor? - Being clear with availability, knowing how to delegate tasks well, being organized, staying on task, and being very open about life in general could be very useful.

What do I wish I knew in BME 200? - I wish I had a better grasp of the schedule to understand due dates, I wish I could have potentially helped more in the design process as opposed to documentation.

Mentor Map -

Sameer Bhatt - Oct 01, 2025, 2:07 PM CDT

Title: Lecture #3

Date: 09/24/2025

Content by: Sameer Bhatt

Goals: Learn about sustainability

Content:

What is sustainability? - Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment.

Try to keep resources in the circular economy instead of ending up in trash fills or other such this, for example, aluminum cans and stuff that have crazy recycling things.

Carbon footprint is gotten through doing a lifecycle assessment, look at the environmental impacts from all the different phases of a product.(Quantitative)

Coffee pods vs pots, actually very similar to each other in terms of carbon footprint because even though the pods seem worse, to create the pots there are extra carbon waste and stuff.

Plastic speculums vs metal speculums - metal uses plastic to be created, gets autoclaved which can be bad for environment, what was found that there is a certain break-even point for the metal. Just depends on the clinics use on which one they should use for their use.

Life cycle greenhouse gas emissions of anesthetic drugs - Propofol is just the goat in literally every aspect, with isoflurane typically being second.

Lots of very interesting examples - all point to essentially saying don't just look at during use and after use what happens, but in addition think about the entire lifecycle ie manufacturing, cleaning(if reusable), etc.

We can make our design more sustainable by being mindful of our use of the 3d printer to create the prototypes. Geometry and shaping can be decreased as well like not have as much filling and stuff to decrease the amount of waste.

Sameer Bhatt - Oct 08, 2025, 2:11 PM CDT

Title: Lecture #5

Date: 10/08/2025

Content by: Sameer Bhatt

Goals:

Content:

WARF is the alumni foundation that helps fund and create the entire cycle of research. For example, they are a big help when trying to get intellectual property licenses.

Common types of IP - Patents, copyrights, trade secrets, trademarks, data, ...

Patents - Rights that are granted by the government(not global but national) and it excludes others from selling your product

90% of patents are non-provisional utility patents

If you use WARF to get said patent, the ownership will be theres!

WARF gets about 400 people each year

Copyright - Creative expression

Trademark - example of this is logos

Trade secrets - something only a company or a person will know, things that aren't known to the general public.

Sameer Bhatt - Oct 15, 2025, 2:01 PM CDT

Title: Lecture #6

Date: 10/15/2025

Content by: Sameer Bhatt

Goals: Understand how to protect the IP

Content:

Andrea actually went into a lot of law stuff with her BME degree as opposed to just becoming a doctor or going straight into industry. Pretty interesting stuff.

Biomedical Engineering innovation can save lives and IP protection allows research to safely transfer into products

IP enables investment, partnerships, and ethical competition

Legal career paths for engineers in IP - technical advisor - STEM Degree but no law degree

Patent Agent - STEM Degree + patent bar

Patent Attorney - Law degree + patent bar

There are other paths which can be found through a quick search online.

Every single career does something different, advisors can help with a ton of advice but when it comes to actual law making and other such law things, they will have to pass the patent bar or actually go to law school.

Skills from engineering in IP

- Research
- Analytical Reasoning
- Technical Writing
- Communication
- Creativity

Timin & publication - Disclose internally first, publishing before filing and offers for sale means you loose your patent rights abroad and possible loss in the US. First to file system, not first to invent.

Utility Patents - Protect how a product works

Design Patents - Protect the unquue visual appearance of a product

I'm not particularly interested in this career path.

Sameer Bhatt - Oct 22, 2025, 1:47 PM CDT

Title: Lecture #7

Date: 10/22/2025

Content by: Sameer Bhatt

Goals: Understand graduate school opportunities

Content:

- Use undergrad experience to "build a story": Gain experience while you can, tie it all together, research is very good
- Figure out what my ideal career looks like. Depending on that, do I need to seriously look into postgrad
- Think about letter of recs very early, need 3 strong ones
- Prepare for the MCAT or the GRE before senior year

Writing your story:

- Legos -> engineer -> aunt dies of cancer -> BME PhD or MD
- Research/Field Interest
- I did this, then that, then the other thing

ABOVE IS NOT OPTIMAL

- Ggeneral: start with what you want to do - thesis statement, Personal statement - What will I achieve at University X and what after

MS as a stepping stone for further education

Reasons - Rewrite the story, MD: need time to prep for mcat

MS will make you more desirable - fill gaps in the resume, higher level of skills, more experiences

Three MS options in BME - Research(1.5-2 yrs), accelerated program(1 year)

BME Accelerated MS p+Porgams - Fall and spring start available, No need for letter of recs, need a 3.0 GPA in the last 60 credits, special consideration to BME undergraduate students.

Can also go to other schools for masters of course - MS in other engineering dept. usually takes longer.

Conclusions/action items:

I don't believe that a masters program would be something I want to pursue however it isn't completely out of the picture.

Sameer Bhatt - Oct 29, 2025, 2:06 PM CDT

Title: Lecture #8

Date: 10/29/2025

Content by: Sameer Bhatt

Goals: Understand FDA Regulations specifically with medical devices

Content:

What kind of device gets regulated?

FDA doesn't determine if the device is safe, instead it weighs the benefits and the risks and the benefits have to outweigh the risks.

Three types of devices - I II and III

I - Low risk - some even get exempt from the FDA, other exceed the limit of exemption and need to be properly regulated by the FDA

II - Moderate/Controlled Risk -

III - High Risk - PMA is used for super small markets otherwise these markets wouldn't pay. HDE is also used for larger markets like a pacemaker.

Testing on animals and other such models typically don't actually work too well because either they are too different or inducing the disease or problem doesn't work.

Regulations are paid for in blood - Usually something has to go wrong before regulations are put in place.

New devices after 1997 have a much higher standard than before

Dalkon shield - contraceptive that was used by 2.2 million women except it just started killing people

Strength and weaknesses to all levels of regulation, less regulation is more innovation but less safe for the consumer

Studies found that recalls don't affect companies who have many different products.

Phillips CPAP recall - 510k approves as no life support or anything. Foam filter started coming off of the machine and started making holes in users lungs. Crazy.

Abbot had to recall 200k because to turn it off during MRI it disabled everything and could never turn on again.

107k medical device reports(MDR) related to spinal cord stimulation for pain in a 4 year period. ~500 were associated with patient death and 78k are associated with a patient injury. Even a small electric shock which leads to a tiny jerk of a muscle can be catastrophic if it happens at the wrong time like driving in a car or walking down the stairs.

Alzheimer and Parkinsons are caused by sticky proteins - growth hormone participation for some kids got hormones from the cadavers and when they turned 30ish years old they all started showing early stages of alzheimer's.

FDA evaluates everything through FMEA analysis and company has to address almost every failure mode possible.

Sameer Bhatt - Nov 12, 2025, 2:03 PM CST

Title: Lecture #10

Date: 11/12/2025

Content by: Sameer Bhatt

Goals: Understand more about IRB research

Content:

Historical problematic research - No laws previously regarding a lot of different research. For example, sometimes test subjects weren't people who could object, ie school children with disabilities, prisoners, or misinformed patients.

Ethical Research Frameworks:

- Nuremberg Code Consent
- Declaration of Helsinnki focus on medical research
- National Research Act US response to US publi c health service of the untreated syphilis study

Belmont Report - Respect for persons autonomy, Beneficence(Max benefits and minimize harms), justice(Who should receive benefits and bear burdens)

DHHS 45 CFR 46 - Common Rule - criteria for approving research, protections for vulnerable groups, requirements for IRB operations

IRB Composition:

- Diversity of membership required(Race, Gender, Cultural along with scientific expertise(MD, PhD, MPH) and non-scientests)

IRB Purpose - Protect rights and welfare of human research subjects

Common Rule Criteria (45 CFR 46):

- Risks no unnecessary risks and appropriate monitoring to prevent adverse effects
- Benefits Potential direct benefits to participants
- Equitable Selection of Subjects Appropriate for research, population that bears the burdens of research also benefits
- Informed Consent Participants make an informed choice about taking part in research
- Privacy Adequate protections for participant privacy

Things not considered research - QI/PE projects do not meet the definition of research

HIPAA considerations:

- De-identifying Data - Needs to be anonymized/Deidentified with ALL identifiers removed

Many different categories of research which can be exempt from research

Non-exempt research

- Surveys of children
- Analysis of identifiable samples
- Blood draws, blood pressure, yoga, etc
- Administering a drug
- Device studies

IRB Review Process - Admin Review, IRB Pre-Review, and Committee or non-committee review

Sameer Bhatt - Dec 10, 2025, 12:02 PM CST

Title: Tong Makeup

Date: 11/14/2025

Content by: Sameer Bhatt

Goals: Learn from a successful graduate from the BME program at UW

Content:

I had an exam during the Tong lecture so I'm watching the video now to make up for it!

(Hasn't been uploaded yet)

Update 12/10/2025: I just realized the Tong Lecture was never uploaded to kaltura so I wasn't able to watch it. Instead, I'll watch an older Tong lecture to make up for it.

Sameer Bhatt - Nov 19, 2025, 1:52 PM CST

Title: Lecture #11

Date: 11/19/2025

Content by: Sameer Bhatt

Goals: How new product development works in the medical device industry

Content:

Russ Johnson - Industrial connections leader

NPD in the medical device industry is highly regulated, expensive, resource intense, and competitive

Selecting and prioritizing projects. Corporate business strategy -> product portfolio review -> project review -> budgeting and resource allocation

Types of npd products:

- Line extensions -> Size and config
- Product improvements -> changes in product
- New-to-company -> New to the company but not real innovative to world
- New-to-world -> Innovative project

Stryker created an automated suction canister system(purchased from a startup)

Orwell fluid management system wanted a solution to collect >8L of fluid during surgery

Stage 0 - ideation (Orwell thought they were market leaders and very smart)

Stage 1 - exploration(Define problem to be solved and customer requirements) Defining the problem is the most important step because there needs to be a clear-cut goal

- Stage 2 Concept Definition(Figure out what the best thing that has been thought of is)
- Stage 3 Design Development (Move to a functional prototype and continue the iterative design process)
- Stage 4 Design Confirmation("Freeze" design at the end of this stage, figure out if you will make in house or buy)
- Stage 5 Design Transfer & Commercialization (Complete testing, make final design changes, develop service plan and resources)

Sameer Bhatt - Dec 10, 2025, 9:44 PM CST

Title: Initial Latch Design Prototype

Date: 11/01/2025

Content by: Sameer Bhatt

Goals: Evaluate the initial design of the latch

Content:





This prototype shows a lot of promise. It fit very well through the cage and the mechanics worked exactly as expected. The client brought up a few worries with this design. First off, because the design having to fit through the cage, the actual rectangular piece is a bit thin which could bring up stress issues. He suggested to just have two large pegs and have a larger rectangular attachment which just fits from outside the cage. I generally agree with this as having a swinging design which fits through the cage seems to be potentially a bit too complicated and his design makes a lot of sense. It will need to be looked into however this is a very promising prototype.

Conclusions/action items:

Some updates definitely have to be made to the design but overall good baseline.



Sameer Bhatt - Dec 10, 2025, 9:47 PM CST

Title: Initial Enclosure Prototype

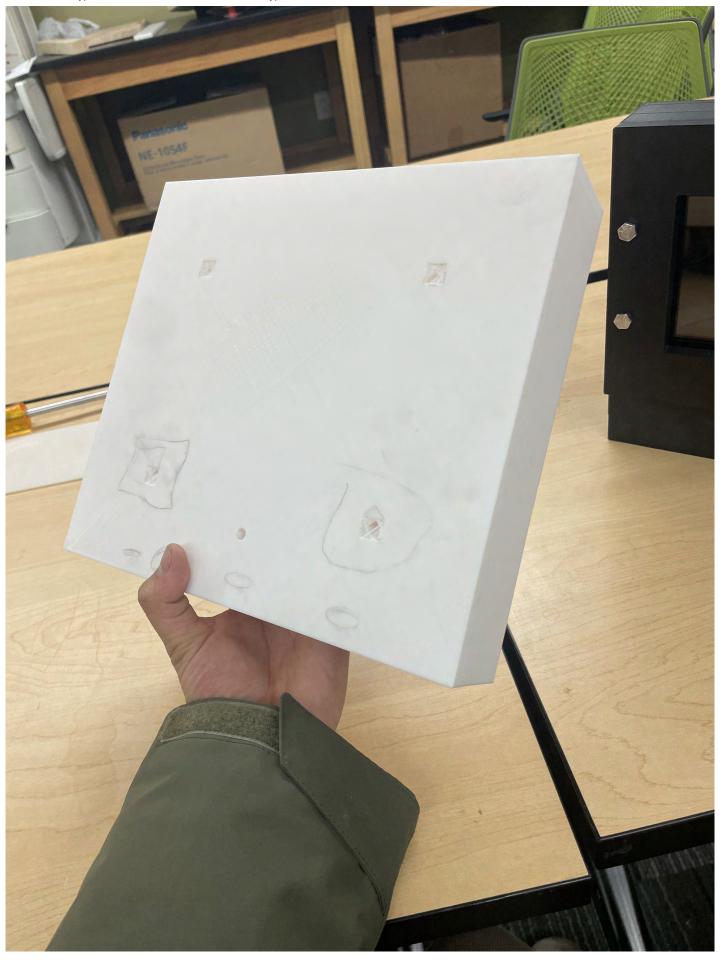
Date: 11/07/2025

Content by: Sameer Bhatt

Goals: Evaluate the initial enclosure prototype

Content:





This design is not meant to be the final but instead more a proof of concept which it definitely is. The pegs seem to fit very well through the cage(although they can definitely increase in size)(also they were broken off in transport accidentally). In the front, the touchscreen just barely doesn't fit so the size of the hole will need to be increased a bit to make sure it can fit. For some future work, most importantly, there needs to be some cable management. I'm not certain how it will be done but the cable slots are in the back of the touchscreen thus something will need to be designed there. Overall, pretty happy with the initial prototype and have a solid direction to go.

Conclusions/action items:

Figure out how to manage the cables and increase size of pegs for strength.



Sameer Bhatt - Dec 10, 2025, 9:51 PM CST

Title: Final Enclosure Prototype

Date: 11/23/2025

Content by: Sameer Bhatt

Goals: Evaluate the final enclosure prototype

Content:





The above pictures have the final enclosure fully put together. As one can see, the front panel is held together by 6 screws and the touchscreen still fully shows. On the back, the pegs are much bigger than the initial design along with holes for cable management along the bottom. It is important to note that the latch attachment style switched from vertical to horizontal to ensure that the cable management holes would not be effected. Overall, the team is extremely happy with this prototype as it functions very well. Definitely a little rough in a few places which could be fixed by a future team(for example the cable management holes are a bit too small and they needed to be filed down for the cables to fit properly).

Conclusions/action items:

Overall, very happy with this final design!

Charlie Fischesser - Sep 20, 2025, 2:48 PM CDT

Title: Rhesus Macaques

Date: 9/7/2025

Content by: Charlie Fischesser

Present: Charlie Fischesser

Goals:

To learn the biology of the rhesus macaques to further understand how to utilize the modular device.

Content:

Evolution

Rhesus Macaques live roughly 25-30 years, even longer to 40 in captivity. They are about the size of an infant human child. Found naturally in Asia, seen a lot in research centers in the states. They are typically colored brown or tan with little fur on their pink colored faces. They walk on all 4 limbs (quadrupedal) and live in either trees or ground depending on location. They are very good swimmers, using water for food or enjoyment. Other than humans, they have the broadest geographic distribution of any other primate. They are also the most studied primate starting with research back in 1959 by Charles Southwick. Rhesus Macaques love to live near humans, coexisting, sometimes surviving on human food. They are omnivores typically seen raiding crops or eating through garbage.

Behavior

They live in groups ranging from 10-80 multi sex individuals. There may be larger groups in mountainous or less human populated regions. Females are the leaders and dominant in their groups while males tend to wander from group to group for mating. Females rarely leave their packs. Rank remains stable, with the youngest offspring taking control after the leader passes. Higher ranked females have the ability to acquire food and space easier than lower ranked. Lower ranked females tend to take as much food as they can and move somewhere safer to eat. Male leaders are unstable. Lots of aggression and fighting lead to leaders being displaced, each leader only lasting for roughly 2 years.

Communication

Facial, body, and gesture impressions are some of the important communication ways other rhesus macaques communicate. Very common is the "silent bared teeth" which is used by lower ranked individuals to threaten the higher ranked. Another common expression is the "fear grimace" used to redirect aggression. Open mouth stare is used by dominant individuals to show who's boss to the lower ranked. They also make various vocal noises including the "shrill bark" as a sign of help in a life-threatening situation.

Conclusions/action items:

Rhesus Macaques have very diverse ways to communicate and an interesting hierarchy system that influences their behaviors. Continue to research more on training and potential frame designs.

References:

https://primate.wisc.edu/primate-info-net/pin-factsheets/pin-factsheet-rhesus-macaque/#behavior-sociality



2025/10/24- Primate Testing with Electrical Devices

Charlie Fischesser - Oct 24, 2025, 1:41 PM CDT

Title: Primate Testing with Electrical Devices

Date: 10/24/2025

Content by: Charlie

Present: Charlie

Goals:

To research more about the safety of electrical devices in the primate environment

Content:

- · Study done with primates using joystick and video display interface
- · Pellet dispenser with tubing for reward
- Stations were secured to wall firmly and encased in protective material
- Lexon was used for protection (polycarbonate sheet)
- · Rugged material, fixed securely, and strong interaction needed
- · Issues with joystick drift, daily checks needed
- Hand/arm needs to be out of reach of electrical components

Conclusions/action items:

Talk to team about our next steps regarding prototyping and order new materials

References: https://link.springer.com/article/10.3758/BF03203490

Charlie Fischesser - Oct 24, 2025, 1:34 PM CDT

Referent Research Medicals, Americana, A. Computer 1981, 24 Sp. 187-188

Testing primates with joystick-based automated apparatus: Lessons from the Language Research Center's Computerized Test System

DAVID A. WASHBURN and DUANG M. RUMBAUTH Juney Corter Life Sciences Laboratory, Garagia Man University, Atlanta, Gaugia

Northerman primation provide, useful models for studying a matery of smokest, bit heades, and to provide thems. Providence of position is used automated toxicing of incursive things the Language teasurest from the Computation of the Studyment (Language Studyment) and principles for an operation testing as the relating special section and material section and an administration of the computation of the section of the sectio

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A CASE STUDY

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SUBJECTS

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Charlie Fischesser - Sep 21, 2025, 4:36 PM CDT

Title: Aluminum Strength

Date: 09/20/2025

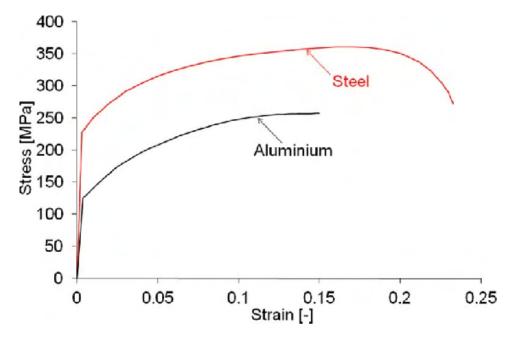
Content by: Charlie Fischesser

Present: Charlie Fischesser

Goals: To determine if aluminum would be a suitable material for our design

Content:

-Aluminum less stiff, more elastic



- -Aluminum bends much easier than steel and breaks
- Roughly 90 MPa
- -Lightweight, stronger than steel in that regard
- -If use a thick bar/plate, monkeys wont be able to bend/deform

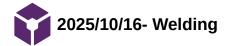
Conclusions/action items:

Talk to team about using aluminum as metal. Look into buying some aluminum to begin prototyping.

Ideal Pure Shear Strength of Aluminum and Copper Stignache Ogaria. ¹²³ Jo II, ¹⁴ Streny Vip¹⁴

Download

science.1076652.pdf (197 kB)



Charlie Fischesser - Oct 16, 2025, 8:57 PM CDT

Title: Welding

Date: 10/16/2025

Content by: Charlie

Present: Charlie

Goals: To research welding as a potential way to bend aluminum/steel for future prototyping

Content:

- Stronger/durable than steel
- · Soft, very sensitive, and contains tough oxidized layer
- When melted, susceptible to impurities
- Oxide needs to be cleaned off of aluminum prior
- · Small region of error
- Tough layer needs high temperature to melt
- Hydrogen can cause bubbles that make aluminum weak
- Use a strong solvent to wash all material off
- TIG (tungsten inert gas) is popular and clean
- MIG (metal inert gas) is a faster approach but affects the quality
- · Lightweight, conducts energy well, non-corrosive, and cost efficient

Conclusions/action items: Discuss with team about methods of altering aluminum, discuss about how to obtain aluminum, discuss next prototyping steps

References: https://www.uti.edu/blog/welding/aluminum-welding

Charlie Fischesser - Oct 24, 2025, 1:26 PM CDT

Title: Types of Aluminum

Date: 10/24/25

Content by: Charlie

Present: Charlie

Goals:

To determine which aluminum would be useful to use for our project

Content:

- · Known for ductility and malleability
- Electrical and thermal conductors
- 2 categories: Wrought and Cast
 - Wrought
 - excel in mechanical strength and forming into many shapes
 - structural integrity
 - Smooth finish
 - Excellent weld ability
 - 1000 is purest (lowest yield and tensile strength)
 - 7000 has alloys of other metals (highest tensile and yield strength
- · 1100- most common grade and highest strength, ductile and conductor, easily bended and welded
- 2000 Series- Includes copper, common aluminum alloy
- 3000 Series- Includes Manganese
- 4000- Silicon
- 5000- Magnesium
- 6000- Magnesium and Silicon
- 7000- Zinc
 - Cast
 - Lower tensile strength (more prone to cracking and shrinking)
 - Avoid for our project
- Aluminum Plates
 - Thickness leading to greater strength and rigidity (ideal for heavy duty)
 - Enhances fuel efficiency and performance
 - Useful for demanding environments

Conclusions/action items:

Discuss with team about which type of aluminum, Order aluminum so we can begin working with it to create frame prototype

References: https://www.iqsdirectory.com/articles/aluminum-metal/types-of-aluminum.html

Charlie Fischesser - Nov 07, 2025, 5:35 PM CST

Title: Raspberry Pi Basics

Date: 11/7/2025

Content by: Charlie

Present: Charlie

Goals: To understand more about raspberry pis on an elementary level

Content:

Single-board computers (SBCS)

Originally created to help teach computer science

Now popular for low cost and small size

68 million units have been sold

Models:

B (2012)- 700 MHz single core 32-bit ARM11 CPU, 512 MB RAM

A (2013)- lower cost than B (256 MB RAM, no Ethernet, and fewer ports)

B+ and A+ (2014)- larger pin GPIO header, microSD support, and video jack

Raspberry Pi 2 Model B (2015)- 900 MHz quad-core CPU, 1GB of RAM

Raspberry Pi 3 Model B (2016)- 1.2 GHz quad-core 64-bit CPU, WIFI and Bluetooth support

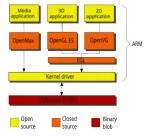
Raspberry Pi 3 Model B+ (2018)- 1.4 GHz CPU, faster Ethernet, dual-band WIFI, PoE support

Raspberry Pi 3 Model A+ (2018)- final A-series model, 512 MB RAM

Raspberry Pi 4 (2019)- 1.5 GHz quad-core CPU, USB 3.0 ports, true Gigabit Ethernet, dual 4k monitors, options for more GB of RAM

Raspberry Pi 5 (2023)- 2.4 GHz quad-core CPU, PCLe support, larger GB options of RAM

Affordable and accessible system that is compatible with many USB input devices



Conclusions/action items:

Finish updating expenses sheet, meet with team to figure out next steps

References: https://en.wikipedia.org/wiki/Raspberry Pi



2025/11/14- Types of 3D Print Materials

Charlie Fischesser - Nov 14, 2025, 3:58 PM CST

Title: 3D Printing Materials

Date: 11/14/2025

Content by: Charlie

Present: Charlie

Goals:

To research 3d printing materials to determine which is best for our project

Content:

2 main types:

Thermoplastics: most common, ability to go through melt and solidification cycles, reversible (analogy of butter)

Thermosetting Plastics: permanent solid state after curing, decompose when heated (analogy of cake batter)

Popular FDM 3D Printing Materials

The most common FDM 3D printing materials are ABS, PLA, and their various blends. More advanced FDM printers can also print with other specialized materials that offer properties like higher heat resistance, impact resistance, chemical resistance, and rigidity.

MATERIAL	FEATURES	APPLICATIONS
ABS (acrylonitrile butadiene styrene)	Tough and durable	Functional prototypes
	Heat and impact resistant	
	Requires a heated bed to print	
	Requires ventilation	
PLA (polylactic acid)	The easiest FDM materials to print	Concept models
	Rigid, strong, but brittle	Looks-like prototypes
	Less resistant to heat and	
	chemicals	
	Biodegradable	
	Odorless	
PETG (polyethylene terephthalate	Compatible with lower printing	Waterproof
glycol)	temperatures for faster production	applications



PETG (polyethylene terephthalate glycol)	Compatible with lower printing temperatures for faster production Humidity and chemical resistant High transparency Can be food safe	Waterproof applications Snap-fit components
Nylon	Strong, durable, and lightweight	Functional prototypes
	Tough and partially flexible	Wear resistant parts
	Heat and impact resistant	
	Very complex to print on FDM	
TPU (thermoplastic polyurethane)	Flexible and stretchable	Flexible prototypes
	Impact resistant	
	Excellent vibration dampening	
PVA (polyvinyl alcohol)	Soluble support material	Support material
	Dissolves in water	
HIPS (high impact polystyrene)	Soluble support material most	Support material
	commonly used with ABS	
	Dissolves in chemical limonene	

Conclusions/action items: Attend Advisor meeting, complete progress report, meet with team to determine next steps

References: https://formlabs.com/blog/3d-printing-materials/?
srsltid=AfmBOopkdU1J5CMzml1JkyljyVKqRIJOXnpvCr267-jM4 clgshqP1LC

Charlie Fischesser - Sep 20, 2025, 1:52 PM CDT

Title: Past Touchscreen Training

Date: 9/18/2025

Content by: Charlie Fischesser

Present: Charlie Fischesser

Goals:

To research previous touchscreen trainings with various animals.

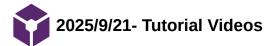
Content:

- -Easily accessible and flexible, making them ideal for research and mental stimulation for researched animals
- -Typically test using trial and error methods
- -2 Methods to train: Automated Training (AUT) and Social Learning
- AUT: designed to train animals without human interference by performing same task over and over. This is usually then rewarded in some form (typically food). Then the task is made more difficult and the process starts again. Benefits include less human involvement/work, more accurate data since animals are learning on their own with little to none human training.
- -Social: Similar to AUT except human involvement is mixed in to training. Results tend to be quicker to obtain than AUT and more ethical with having human encouragement being a major factor. Can move into an AUT system after having human involvement if desired.
- -Social tends to have much better results than AUT, mainly requiring less attempts.
- -Important to alter training based on animal sleep/tiredness throughout the day as well as lighting (some animals are more prone to light than others)
- -Be wary of sound as to not startle the animal or cause chaos
- -Make screen size appropriately sized (29 x 29 cm in this project)
- -Ideas for software: red square on screen until touched (used for marmosets), showing two images side by side changing randomly (used for baboons)

References: https://dl.acm.org/doi/fullHtml/10.1145/3565995.3566044

Conclusions/action items:

Check with regulations with our device to ensure we are using the correct parameters. Research about durability, materials, and frame.



Charlie Fischesser - Sep 21, 2025, 4:52 PM CDT

Title: Tutorials

Date: 9/21/2025

Content by: Charlie Fischesser

Present: Charlie Fischesser

Goals: To learn basics of SolidWorks in order to create future CAD designs

Content:

https://youtu.be/8lHEizPf-wY?si=Z_ciy3crNvb2hbyv

Conclusions/action items:

Work on practicing SolidWorks, try to create a basic model of the frame and circuitry box connected to the cage

Charlie Fischesser - Sep 24, 2025, 8:49 PM CDT

Title: CAD Drawing 1

Date: 9/24/2025

Content by: Charlie Fischesser

Present: Charlie Fischesser

Goals:

To create a brief CAD drawing of the circuit box to expand upon in future.

Content:

See PDFs

Conclusions/action items:

Show team initial CADS. Adjust lengths and add wires and a way to open the box.

Charlie Fischesser - Sep 24, 2025, 8:46 PM CDT



SOLIOWOVER Educational Product. For Entransform Use Only.

Download

1st_Stage_CAD.pdf (435 kB)

Charlie Fischesser - Sep 24, 2025, 8:48 PM CDT



SOUDWOYSE Educational Product. For Instructional Use Or

Download

Other_Side_1st_Drawing.pdf (443 kB)

Charlie Fischesser - Oct 16, 2025, 8:02 PM CDT

Title: CAD Longitude Design

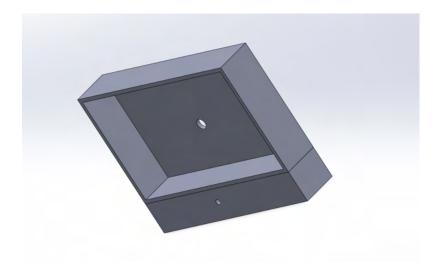
Date: 9/26/2025

Content by: Charlie Fischesser

Present: Charlie Fischesser

Goals: To create a design that has the touchscreen on top of the circuitry box to show team

Content:



Conclusions/action items:

Show team design and decide on a final design to move forward with

Charlie Fischesser - Sep 20, 2025, 2:42 PM CDT

Title: Individual Brainstorm

Date: 9/20/2025

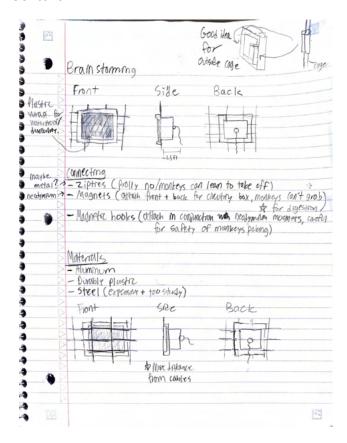
Content by: Charlie Fischesser

Present: Charlie Fischesser

Goals:

To brainstorm ideas and get mental images onto paper

Content:



Conclusions/action items:

Brainstormed some general ideas for the design, connectivity, and materials. Research about aluminum versus plastic, plastic wrap functionality for touchscreen, and the various ways to connect the frame to the cage. If time permitted, try to get cad models of design.



Charlie Fischesser - Sep 20, 2025, 2:44 PM CDT



This certifies that Charlie Fischesser has completed training for the following course(s):

Course	Assignment	Completion 9/8/2025	Expiration 9/8/2030
Biosafety Required Training	Biosafety Required Training Quiz 2024-2025		
Chemical Safety: The OSHA Lab Standard	Final Quiz	9/8/2025	

Data Last Imported: 09/20/2025 02:23 PM

Charlie Fischesser - Sep 24, 2025, 8:53 PM CDT



Profile

My Memberships						
Membership Type	Start Date	Expiry Date	Renew	Card Info		
Machining	Wed, Aug 20 2025	Permanent	Not Renewable	N/A		
Shop Tools	Tue, Aug 20 2024	Thu, Jan 2 3000	Not Renewable	N/A		
Laser Cutter	Tue, Aug 20 2024	Thu, Jan 2 3000	Not Renewable	N/A		
Lab Orientation	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A		
Shop Tools - Training Eligible	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A		
Laser Cutter - Training Eligible	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A		

Charlie Fischesser - Sep 26, 2025, 1:00 PM CDT

Title: BPAG Meeting

Date: 9/26/2025

Content by: Charlie Fischesser

Present: Charlie Fischesser and other BPAGS

Goals:

To understand my role fully by attending an informational session led by Dr. Puccinelli

Content:

Get Client to purchase materials

Have all expenses approved by client prior to purchase

Any purchase over 1000 must have departmental approval

keep track of all purchases

- -All detailed receipts in notebook
- -Table of expenses (already have)

UW funds? (yes?)

Only one to purchase materials

Fund number for client (ask in next meeting)

50 dollar budget for Makerspace (Account Name: BMEDesign)

Only BPAG should be reimbursed

E-Reimbursement (VERY LAST RESORT)

Original Receipts (invoices (date, amount, vendor, etc.)

Non-Reimbursable expenses

- -Lab Notebook- roughly 15 per team
- -Poster Print- 50 per team

Don't ask client to pay, discuss with team to divide

Accounting Table

Use template online

Keep in progress reports and notebooks

If need to send proposal send before 11am Wednesday

Gifted from client/materials from closets: document in table (pump)

Conclusions/action items:

Check with Logan about the purchased Raspberry Pi and receipts. Ask client about his desired way of purchasing and the pump details we are using gifted by him. Update accounting chart this weekend.

Charlie Fischesser - Oct 30, 2025, 4:56 PM CDT

Title: Show and Tell Rough Script

Date: 10/30/2025

Content by: Charlie

Present: Team

Goals:

To create a rough guideline script to follow during presentations on 10/31/2025

Content:

Components:

- -Touchscreen
- -Prototype
- Circuitry
- Touchscreen Device to assist in training monkeys
- Primary concern is safety (keeping wires and electrical components away)
- -Sturdy (monkey can put a lot of force on touchscreen and frame and not break/deform it)
- High water resistance for potential urination issues
- New idea is to have the touchscreen inside and electrical components outside in two compartments that attach
- Problems with power supply
- Best material: Aluminum sheets (worried about weight)

Questions:

- 1) Latching Mechanism (more efficient designs than our own design)
- 2) Better way to attach doors?
- 3) Attach or Leave it on cart?

Conclusions/action items:

Present show and tell and take notes on peers ideas and concepts

Charlie Fischesser - Nov 07, 2025, 5:16 PM CST

Title: Tong Lecture

Date: 11/7/2025

Content by: Charlie

Present: Charlie

Goals: To listen into a distinguished alumni entrepreneurship lecture and learn some tips for future work.

Content:

Three Stages

- 1) Foundation (school and beginning jobs outside education) (personal)
- 2) Climbing the Growth Curve (more jobs with an executive focused) (how to work with teams, bigger impact, IQ with EQ)
- 3) Build and Transform

You don't need to know your destination just follow problems and build skills to make an impact Quadruple Aim: Improved Provider experience, Improved Patient experience, Lower cost of care, Improved Patient outcomes

US ranked last on equity, access and outcomes

25% skip because of cost

Challenges: Misaligned incentives, fragmented financing/regulation, Inequities

Build a better Healthcare: Human centered design, systems thinking, design and iteration, aligned incentives and measurement (rewarded for outcomes not activity)

5 Tips

- 1) Work hard and Build Range (take on hardest projects, effort and range are foundation)
- 2) Diverse Exposure (explore different teams, geographies, and sectors, Gain perspective and learn how systems connect)
- 3) Choose your people wisely (surround yourself with curious driven high integrity people, they will shape you)
- 4) Know your values and protect them (define what matters most (family, health, career) and make decisions that align)
- 5) Embrace Challenge and Keep Growing (run towards hard problems, Growth is from discomfort)

Conclusions/action items:

Meet with team for advisor meeting, figure out power supply issue, order new power supply if cant solve

Charlie Fischesser - Oct 16, 2025, 8:13 PM CDT

Title: Cardboard Prototype

Date: 10/16/2025

Content by: Charlie

Present: Charlie and Kalob

Goals: To create a cardboard prototype to show advisor and client for initial idea.

Content:



- · Created a prototype made of cardboard
- Used 1:2 ratio for modeling
- Used scotch tape for binding parts together
- One side is off to show future detach ability and "door" of the touchscreen (see this in video attachment)

Conclusions/action items:

Finished cardboard prototype, show team, advisor and client to discuss complications and share ideas, Look into welding and easiest way to bend aluminum to correct shape

Charlie Fischesser - Oct 16, 2025, 8:13 PM CDT



Download

Cardboard_vid.MOV (975 kB)



Charlie Fischesser - Nov 18, 2025, 2:10 PM CST

Title: Kamoer KPHM400-ST high Flow Stepper Motor peristaltic Pump 24V Variable Speed lab Liquid dosing Pump 0~400ml/min

Date: 11/18/2025

Content by: Charlie

Present: Charlie

Goals: To determine a backup pump option in case the pump we have is broken

Content:

Well fixed pump tube

24V, 0.3 A, 400ml/min flow rate, 400rpm, 304g

Good resistance materials

Useful for research projects

Price: 39.99

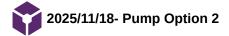
Can arrive in a day

K Kamoer Brand



Conclusions/action items: Talk with team about which option they want to move forward with and order the pump

References: https://www.amazon.com/Stepper-peristaltic-Kamoer-KPHM400-Variable/dp/B097XXJ1XD/ref=sr_1_1_sspa?
crid=3S6GSG54PEB5S&dib=eyJ2ljoiMSJ9.YfB6UXKiJ4e_Hav6aVZUG2_2OBMRynm0w52CLRnEhBQlXlYcvy_MOBHaaDjG0oWFE0uDx5GpeEl32n7KllsQWWJWCoVAU18SMl5jFkivlJDBEsMCMBJmvr86toja4ORcROKZp1El9aig7sLRO39KX1RMj0BXbLEb4L0l84ib1SYnlXuXAO_qeTZpL6Jb9yQ0EMA5FDP3IREm3w4qmHEA7dH8KlFRYnvSRlmcLo-pE.qfOR6HAz00n6eisk2AoDFYcg_loJS2Pc_UoX0QhY0M&dib_tag=se&keywords=peristaltic+pump+24V&qid=1763495409&sprefix=peristaltic+pump+24v%2Caps%2C113&sr=8-1spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&psc=1



Charlie Fischesser - Nov 18, 2025, 2:10 PM CST

Title: 24V DC DIY Peristaltic Liquid Pump Dosing Pump for Aquarium Lab Analytical 10ml/min -90ml/min(black)

Date: 11/18/2025

Content by: Charlie

Present: Charlie

Goals: To determine a good backup pump option in case the pump we have is broken

Content:

Aquarium Lab pump

Easy to disassemble/maintain

Supports CW and CCW

Control flow direction

No valves/seals, easy maintenance

Price: 15.50 (poor reviews)

Delivery within a couple of days

Hyuduo Brand





Conclusions/action items: Meet with team to discuss with option to move forward with and order the option in quick succession.

References https://www.amazon.com/Peristaltic-Liquid-Dosing-Aquarium-Analytical/dp/B087GFL4CW/ref=sr 1 4?
crid=3S6GSG54PEB5S&dib=eyJ2ljoiMSJ9.YfB6UXKiJ4e Hav6aVZUG2 2OBMRynm0w52CLRnEhBQlXlYcvy MOBHaaDjG0oWFE0uDx5GpeEl32n7KllsQWWJWCoVAU18SMl5jFkivIJDBEsMCMBJmvr86toja4ORcROKZp1El9aig7sLRO39KX1RMj0BXbLEb4L0l84ib1SYnlXuXAO qeTZpL6Jb9yQ0EMA5FDP3IREm3w4qmHEA7dH8KlFRYnvSRlmcLo-pE.qfOR6HAz00n6eisk2AoDFYcg loJS2Pc UoX0QhY0M&dib tag=se&keywords=peristaltic+pump+24V&qid=1763495904&sprefix=peristaltic+pump+24v%2Caps%2C113&sr=8-4

Charlie Fischesser - Nov 18, 2025, 2:09 PM CST

Title: Metering Peristaltic Pump G928, 500ml / min Large Ball Bearings 304 Stainless Steel Pump for Aquarium Laboratory (24V)

Date: 11/18/2025

Content by: Charlie

Present: Charlie

Goals: To determine a good backup pump option in case the pump we have is broken

Content:

24V/500 mL

High quality material and long service life

Steel screws

500 mL/min

Price: 40.40

Delivery by December 1-10

Good Reviews

Yanmis brand



Conclusions/action items: Meet with team to discuss with option to move forward with and order the option in quick succession.

References: https://www.amazon.com/Metering-Peristaltic-Bearings-Stainless-Laboratory/dp/B088BTL5Y1/ref=sr16?
crid=3S6GSG54PEB5S&dib=eyJ2ljoiMSJ9.YfB6UXKiJ4e
Hav6aVZUG2
2OBMRynm0w52CLRnEhBQIXIYcvy
<a href="mailto:MOBH-400BH-4000MB

Charlie Fischesser - Nov 18, 2025, 5:03 PM CST

Title: DC Vacuum Pump Strong Suction Self Priming Peristaltic Pump, High for Aquarium Chemicals Liquids and Other Dosing Additives (12V)

Date: 11/18/2025

Content by: Charlie

Present: Charlie and Team

Goals: To determine a good backup pump option in case the pump we have is broken

Content:

Met with Team and found this pump

Arrives this week, 44 dollars

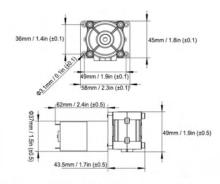
Hilitand Brand

24 V, 400 ml/min

Similar shape and structure from last pump







Pipe: Approx. 6.4×9.6 mm / 0.3×0.4 in (Inner Diameter x Outer Diameter) Wall Thickness: Approx. 1.6mm / 0.1in

Conclusions/action items: Order this pump if we fully decide on moving forward with this option. Continue to look for more if not.

References https://www.amazon.com/Self-Priming-Peristaltic-Aquarium-Chemicals-Additives/dp/B07J2JDT54/ref=pd_ci_mcx_di_int_sccai_cn_d_sccl_1_21/147-3109778-0121457?

pd_rd_w=BH8WQ&content-id=amzn1.sym.751acc83-5c05-42d0-a15e-303622651e1e&pf_rd_p=751acc83-5c05-42d0-a15e-303622651e1e&pf_rd_r=ABT32YTS1AK67FGJTKV0&pd_rd_wg=QlTkz&pd_rd_r=607de251-477b-4bcd-81da-45fa9a7445a3&pd_rd_i=B07J2JDT54&psc=1



2025/09/08-Thomas InCage Training System (ICTS)

Andrew Dirkse - Sep 08, 2025, 2:06 PM CDT

Title: Thomas InCage Training System (ICTS)

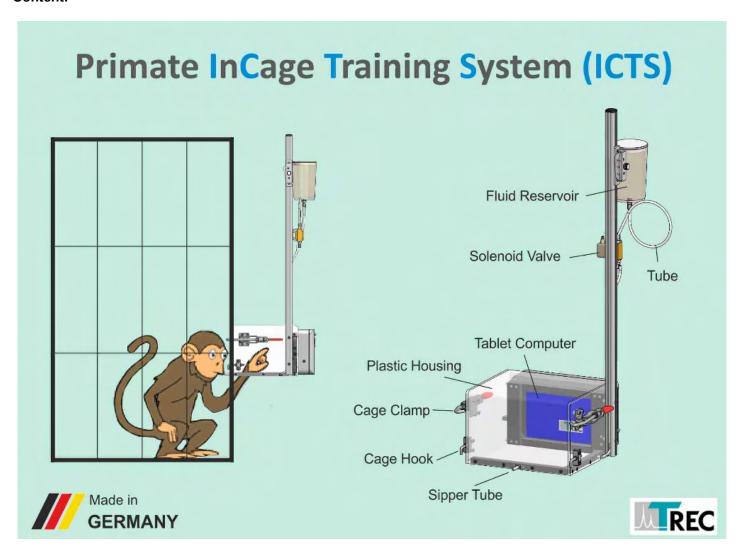
Date: 9/8/2025

Content by: Andrew Dirkse

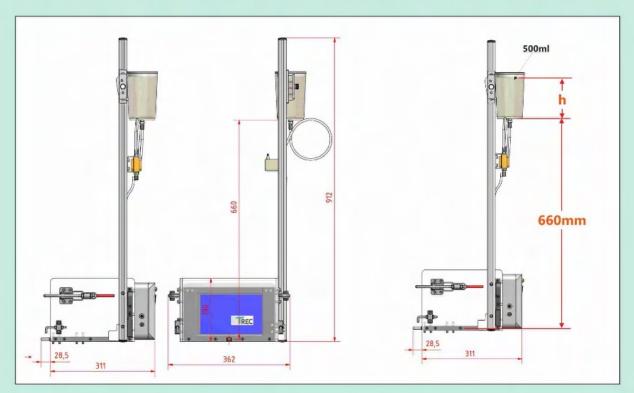
Goals: Individual research to better understand the design of the Thomas ICTS, main design competitor according to

client.

Content:



Primate InCage Training System (ICTS)







Specifications

- Screen encased within plastic housing, with tablet computer on back and cage clamps on either side (dimensions: 362 x 311 x 190 mm). Sipper tube 28.5 mm long, on middle bottom front of housing.
- Fluid reservoir attached 660 mm of the way up a 912-mm pole. Fluid dispensation controlled with solenoid valve.

Video (on website)

- Samsung phone is the computer to be inserted.
- The bottom two hooks rest on the horizontal cage bars, and the top two clamping mechanisms hold it in place.

Conclusions/action items:

- Discuss at next meeting (9/15) w/ David what features of this design we'd like to keep, adapt, or replace. In particular:
 - As per 9/8 meeting, we intend to use Raspberry Pi, not Samsung phone.
 - All data should be stored locally (e.g. SD card), not WLAN/Wi-Fi like the Thomas system.
 - Where to put the juice dispenser? Will become clearer when we see the system David already has.
 - The Thomas ICTS costs ~\$100K. Budget shouldn't be an issue.

References: https://www.thomasrecording.com/thomas-incage-training-system-icts

Andrew Dirkse - Sep 19, 2025, 3:39 PM CDT

Title: Competing Design: Noroozi et al. (Development of an Automated Training Device for Macaque Monkeys)

Date: 9/16/2025

Content by: Andrew Dirkse

Goals: To better understand the design choices made by Noroozi et al. and how they might apply to our design.

Content:

Goals:

- Cost effective
- In-cage
- · Use only basic equipment
 - Touch screen monitor
 - PC
- Modifiable code (i.e. extensible)
- Task: Delayed Match-to-Sample (DMS)
- Takes 30/33 days to learn (n = 2).
 - Significantly shorter than out-of-cage training.

Introduction

- McMillan et al. (2017): time required to train monkey for chair restraint is 2-8 weeks.
 - Varies depending on techniques used and monkey's temperament.
- There is a need for a device that can be used to train the monkey in their home environment.
- Desiderata:
 - Cost effective.
 - Lightweight
 - Portable
 - Remote control (?)
 - open source
 - compatible w/ different cage types (?)
 - real-time observation of monkey behavior during tasks
 - Sturdy
 - Monitor monkey w/out constant lab presence
- Name: ATD (automated training device)

• Design

- Computer setup
 - PC
 - Touch screen
- Reward
 - Peristaltic pump DC 6V/12V
 - DC motor L298N
 - Arduino Uno
 - Reward source
- · Remote control unit

- GSBWA-Fi adapter
- Fast Remote Desktop Application

Computer Setup

- PC must meet reqs to e.g. run MATLAB
- Touchscreen linked to PC via HDMI cable

Reward System

- Arduino is programmed to use PC USB port to send reward trigger signal and control the pump's activation + deactivation.
- Trigger must be sent w/in max time of 3 sec
- L298N module is a two-channel H-bridge driver for DC and stepper motors
- Peristaltic pump, positive displacement pump, is used for pumping fluids (usually juice)



Figure 2. Schematic image of the reward system. The reward system comprises a 1). Personal computer (PC), 2). Arduino Uno, 3). DC motor L298N, 4). Peristaltic pump DC 6V/12V, 5). Reward output, 6). Reward source.

• Remote-Control Unit:

- Training system connected to internet through network card (for remote control)
- Camera to observe monkey
- Modifications possible:
 - behaviors
 - reward reception during tasks
 - reward quantity

Cage mounting frame

- Frame with wheel bases: mobile platform
- 50 x 60 x 90 cm (aluminum)

• Delayed match-to-sample task

- Step one: touch the monitor
 - Reward upon any touch of the screen
 - Applying honey to the screen to make it more appealing
 - 200 trials per session: total 15 to 25 minutes, repeated w/in a day
- Step two: resizing the stimuli

- Continuously reduced size of stimulus
- 1024x1280 pixels to 192x192 pixels
- Step three: random location of stimuli
 - Associate choosing images in various locations with reward
 - Ensure the animal focuses on sample image
 - 97% accuracy average for two monkeys
 - Delayed match-to-sample (DMS) task tests working memory
- Step four: visually guided touch
 - Teach DMS task
 - Sample image displayed at center of screen (sample presentation)
 - Animal received reward for touching the image
 - Blank screen for 1000 ms
 - Same image randomly appeared on either right or left side
 - If animal successfully touched the image, it received a reward
 - Otherwise, it moved on to the next trial
 - Gradually decreased reward for sample presentation
 - M1: 28 sessions over 7 days to achieve 85%
 - M2: 36 sessions over 9 days to achieve 85%
- Step five: teaching DMS task with transparency
 - Train association between receiving a reward and selecting a target image that matched the prototype image regardless of distractor
 - Initially made distracting image transparent (0.6 -> 0.7 ->...)
- Step six: DMS task
 - Distractor image no longer transparent (transparency = 1.0)
 - M1: 30 days; M2: 33 days

Conclusions/action items:

• Their solution differs somewhat from ours. They used a PC and a wheeled base; we are using a Raspberry Pi and a clamping mechanism.

Reference: J. Noroozi et al., "Development of an automated training device for macaque monkeys," *Basic Clin. Neurosci.*, to be published.

Andrew Dirkse - Sep 19, 2025, 3:43 PM CDT

Title: Ramezanpour et al.

Date: 9/18/2025

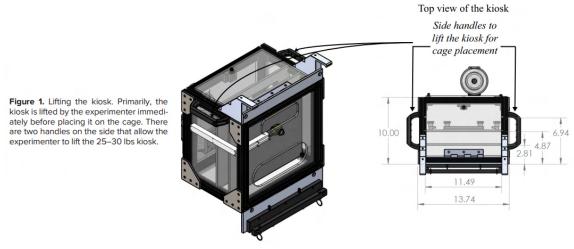
Content by: Andrew Dirkse

Goals: Understand the design choices made by the authors for their goals

Content:

- · The "kiosk"
 - o set up within the animal's housing environment
 - more hands-off approach to training
 - o more nuanced collection of behavioral data
 - reduce stress on the monkey
- More papers to look at
 - o Crofts et al.
 - Mandell and Sackett
 - Calapai et al.
 - Jacob et al. (eye-tracking?)
- Motivation
 - No separate area for computer management
 - Easily removable for cleaning
 - Unified software framework for assessing multiple cognitive aspects
 - o Options to connect to internet or Bluetooth
 - Low weight
 - Portability
 - · Use of publicly available touchscreens e.g. iPads
- · Kiosk description
 - o 25-30 lbs weight
 - o 1260 CAD (913 USD) to make
 - o (calculates NIOSH lifting equation safe weight lifting limit as 51 lbs.)

Kiosk can be carried in a cart and only needs to be lifted right before placing on cage bars.



- Kiosk is attached out outer side of cage, so reduces accumulation of debris from inside the box
- Nozzle for liquid is positioned so that any water drips fall outside the box
- Tubes used for liquid delivery will need to be cleaned
- o Cleaning of box every few weeks is sufficient.
- Wiping down exterior surfaces and apertures
- · Software control
 - Kiosk can be integrated flexibly with any behavioral control software that registers touchscreen
 - They use MWorks
 - MonkeyLogic: they didn't use because primarily designed for two screen setups. Also MonkeyLogic may only run on Windows devices
- GitHub video for placement (https://github.com/vital-kolab/nhp-turk/blob/main/videos/Placement.mp4)
- · Internal components
 - When the kiosk is attached to the cage, experimenters can still access parts of the kiosk to...
 alter experiments, change out fluid, replace batteries, etc.
 - Majority of components are polycarbonate sheets

Billed at https://github.com/vital-kolab/nhp-turk/blob/main/Bill.of.Materials.xlsx

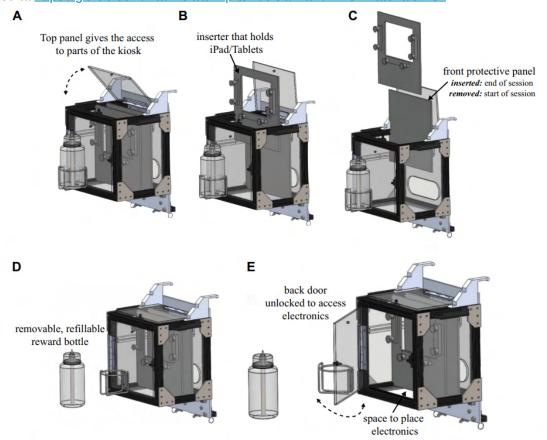
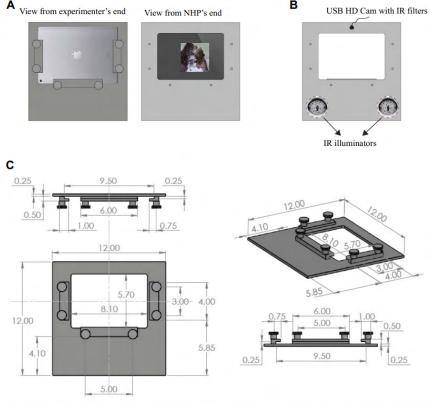


Figure 4. Interacting with the kiosk. A: the top panel that remains attached to the kiosk can be opened to access the rest of the kiosk. B: one of the detachable inserter panels holds the tablet/touch screen. C: a protective front panel is inserted at the end of the experimental session to protect the electronics at the back of the kiosk from the monkey. It is also removed at the beginning of the session to allow the monkey full access to the touch screen. D: a removable bottle is placed in a dedicated attachment in the back of the kiosk to hold the reward fluid (typically water). The bottle can be removed daily to refill the fluid. E: the back door (that stays attached to the kiosk) can be opened to insert the electronics, and make proper adjustments (e.g., tighten the tablet into the inserter).

- Top panel can be pulled open to access content
 - Insert tablet/touch screen
 - Dry treats, toys
 - Adjust electronics
- Back panel
 - Insert electronics
 - Reward fluid bottle
 - Bottle has tube inserted that is connected to a pump

Via another tube to front nozzle to get reward



В

Figure 5. The touch screen/tablet inserter panel, A, left: the view from the experimenter's end. The knobs can be loosened to insert the tablet from the top of the kiosk. The back of an iPad is visible in the figure as an example configuration. *Right:* the view from the monkey's end. The visual stimulus can be seen in the example. The monkeys can touch this screen to indicate their choices. *B*: possible items to add to the setup via this inserter. Apertures can be drilled at the bottom to allow for two IR illuminators. A small hole at the top of the inserter panel can be used to insert a high-definition USB camera with an IR filter. These can be combined to develop a low-cost eye tracking system (available in future versions of the kiosk). C. the dimensions of the touch screen/tablet inserter panel. The exact dimensions can vary based on the make of the tablet used. The aperture size can be smaller than the touch screen if the entire screen is not used in the tasks. However, the size should not be larger than the touch screen since that will allow the monkeys to access the electronics (usually placed behind the touch screen).

Inserter panels <u>can</u>be removed from kiosk

- Front panel is inserted at end of experiment so that monkey cannot access electronics at back of kiosk
- Tablet is removed for charging at end of day
- Panel is removed at beginning of experiment so that monkey can access touch screen
- Second inserter panel holds tablet/touch screen, could be left in at all times
- Back of this panel has brackets and knobs to securely place tablet into slot

Reward system

- Removable, refillable reward (water, juice, etc.) bottle can be attached to back of kiosk.
- Advised to only fill once secured to the kiosk
- Bottled water connected to nozzle (accessible to animals)
- TCS high-quality miniature micropump
- Mounted on inner side of back door of apparatus
- Pump features two connecting ports
- First port connected to short tube 20 cm long
- Connects to reward bottle
- Second port is connected to 40 mm tube
- Routed through plastic chamber attached to kiosk's side
- Tube is connected to drinking nozzle
- Animals don't have direct access to tube

Micropump powered by V50 USB Battery Pack

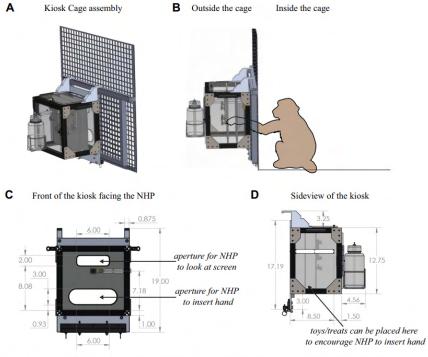


Figure 6. Kiosk components critical for nonhuman primate (NHP) interactions. A: Kiosk Cage assembly. Before the NHP is allowed to interact with the tablet by removing the front-most protective inserter panel, the kiosk has to be securely attached to the cage. B: the monkey accesses the touch screen by sitting right in front of the kiosk on a horizontal cage divider panel. C: the front of the kiosk facing the NHP has two apertures. The top one allows for clear visual access to the NHP. The bottom one allows the NHP to insert its hand and interact with the touch screen. D: sideview of the kiosk illustrates the space at the front that can be used to insert toys and treats to initially encourage the NHP to get their hands in via the aperture.

- Animal-kiosk interaction
 - Kiosk attaches to cage
 - Two apertures: one to see screen, one to insert hand
 - The edges of these apertures have been smoothened with sandpaper to ensure that the monkey does not cut its arms!
- Task: delayed match-to-sample.
 - Monkey was head-fixed

Conclusions/action items:

Reference:

H. Ramezanpour, C. Giverin, and K. Kar, "Low-cost, portable, easy-to-use kiosks to facilitate home-cage testing of nonhuman primates during vision-based behavioral tasks," *J. Neurophysiol.*, vol. 132, no. 3, pp. 666-677, Sep. 2024, doi: 10.1152/jn.00397.2023.

Andrew Dirkse - Oct 03, 2025, 3:57 PM CDT

Title: Mymou

Date: 9/19/2025

Content by: Andrew Dirkse

Goals: Understand the design choices made by the authors and how they might differ from ours

Content:

Introduction

- NHPs have to acclimatize to their environment during training
- Have to enter a testing chair (sometimes via pole and collar)
- o Transport to testing setup, separating from comfort of home env. and peer group
- o Experiments may require NHPs to indicate behavioral responses
- o NHPs only trained for 1-2 h a day usually
- Either become tired or sated w/ reward
- Chair restraint and separation from peers can increase stress levels in NHPs (papers!)
- Dependent on NHP's being tired, sated, motivated...
- Papers on automated testing systems (and other unpublished systems)
- Must separate from their peer group
- Invasive implants
- Manual sorting of footage of NHPs
- Some require specialist components
- Goals ("sales pitch")
 - Low cost, open source
 - Can run continuously all day (over weekends) w/o supervision/intervention
 - Uses Java for extensibility

Features

- Behavioral testing unit (BTU)
 - Android tablet + mount
 - Android Studio
- Reward-delivery interface (RDI)
 - Arduino Uno, Bluetooth, A to B USB, Power adapter
 - Arduino IDE
- o Communicate wirelessly over Bluetooth
- Costs 385 Pound sterling (=US\$516)
- Behavioral testing unit
 - Android 6.0.0 and above, Bluetooth and front-facing camera
 - Holder made from acetal plastic, in-house
 - o Holder could be left mounted on the cage, and tablet slid in and out
 - 3-D model of holder <u>available on GitHub</u>
- Reward-delivery interface
 - RDI is a mediator between BTU and RDS
 - o Arduino Uno microcontroller board

- Additional Bluetooth module receives commands from BTU and controls RDS
- Four channel peristaltic pump
- Also been used with food pellet delivery systems

Software

- Written in three languages
 - Java for behavioral tasks
 - C++ to control RDI
 - Python to train facial recognition system
- Java (BTU)
 - Can specify time of day that subjects can use system
 - Inactive periods: device enters dormant state, black screen, low brightness, does not register touches
 - End of day: timer triggers reward pump to flush water to clean system
 - Saves all data to device's internal memory
 - Can also write to external SD card
 - Data stored in new folder each day, named for date of training
 - I: images
 - F: facial recognition system
 - Text: behavioral events
 - One row per event
 - Columns: timestamp, photo, outcome...
 - BTU can email info to experimenter.
 - Can be trial data or info about device itself (battery, lost connection)
 - Error monitoring
- C++ (RDI)
 - Arduino IDE
 - No alterations from experimenter required
 - Receives event codes from BTU via Bluetooth
 - Activates/deactivates RDS channels appropriately
 - One unique event code activates a particular channel, and a second unique event code deactivates the channel.
 - "Passive mediator" between BTU and RDS
- Python (ANN facial recognition training)
 - Don't think this is relevant for our project right now, but might be in future semesters as a future direction.
- Security
 - Android OS is encrypted and password protected
 - Device can be run w/o internet connection (except email function)
- Results
 - System was left on cage even while not in use (sleep mode)
 - Tablet could last a full experimental day

Conclusions/action items: Discuss ideas w/ team

Reference:

J. L. Butler and S. W. Kennerly, "Mymou: A low-cost, wireless touchscreen system for automated training of nonhuman primates," *Behav. Res. Methods*, vol. 51, no. 6, pp.2559-2572, Dec. 2019, doi: 10.3758/s13428-018-1109-5.

Andrew Dirkse - Oct 07, 2025, 12:55 PM CDT

Title:

A cage-based training, cognitive testing and enrichment system optimized for rhesus macaques in neuroscience research

Date: 10/03/2025

Content by: Andrew Dirkse

Goals: Understand goals and design choices made by Calapai and coauthors

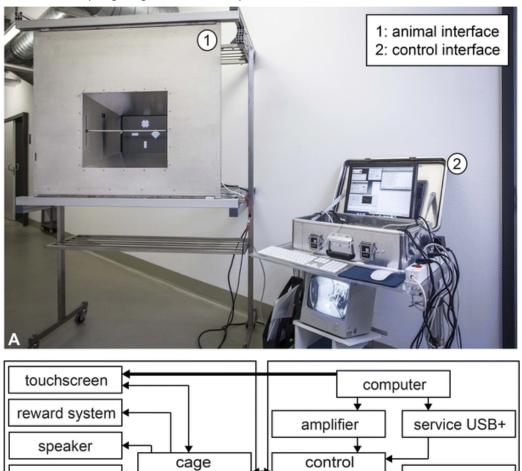
Content:

• Introduction

- Macaques are required to leave the housing facility
- Moved by means of a primate chair
- Limits scope of research questions
- o Restraints: animal welfare concerns
- Limits self-paced engagement
- In-cage might better motivate monkey
- XBI: experimental behavioral instrument
- · Robust and spray-water resistant
- o Precise fluid reward system

Methods

- Cage-mountable
- Electronics protected against dirt and spray water
- Robust to resist forces applied by animals
- Operatable by non-expert personnel
- Flexible hardware and software to allow for a variety of procedures and task designs



connector box

control interface

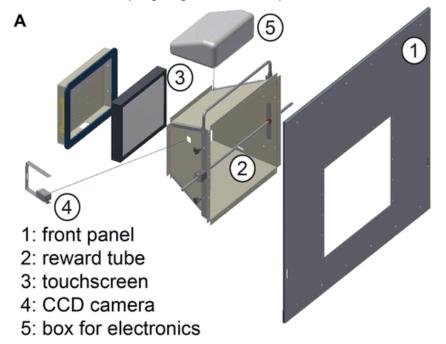
video server

Animal interface and control interface

camera

animal interface

connector box







• AI (animal interface)

- Part that is accessible to animals
- Transported using wheeled frame
- "Funnel" that narrows to the touchscreen
- o Resolution of 1024 x 768 at 75 Hz
- Resistant against mechanical forces
- Animals usually operate the device with the reward tube as close as possible to their mouths. (Matches client's advice)
- Eye to screen: 28-32 cm
- Visual angle: 54 degrees horizontal, 42 degrees vertical
- o 2.5 L fluid container, PVC tube, replaced every 2 weeks
- Peristaltic pump
- 1.8 mL/s +/- 0.01 mL

Conclusions/action items: Discuss ideas (mainly mechanical) with team

Reference: A. Calapai, M. Berger, M. Niessing, K. Heisig, R. Brockhausen, S. Treue, and A. Gail, "A cage-based training, cognitive testing and enrichment system optimized for rhesus macaques in neuroscience research," *Behav. Res. Methods*, vol. 49, no. 5, pp. 35-45, Feb. 2016.

Andrew Dirkse - Oct 10, 2025, 3:46 PM CDT

Title: Notes on Fizet et al.

Date: 10/10/2025

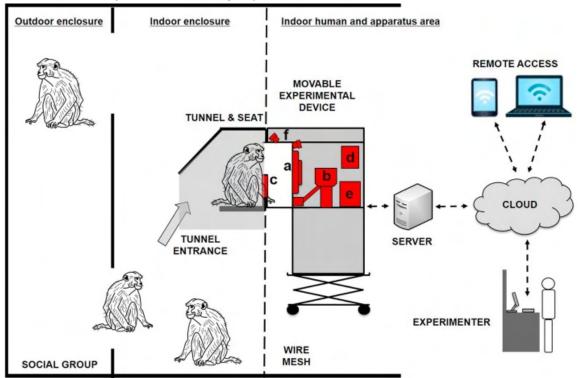
Content by: Andrew Dirkse

Goals: Understand decisions made by Fizet et al. as they relate to their goals

Content:

- Introduction
 - Animal welfare concerns
 - Reduction in number of subjects
 - Semi-automated deices incorporating computer
- Computerized systems (e.g. touchscreens) benefits:
 - Reduced interaction between NHP and human
 - Increased number of tests can be administered
 - Better standardized experimental designs
 - Improved measurement accuracy
- · Considerations:
 - Subjects may need to be restrained for a time.
 - May take weeks/months of daily training before performance is stabilized.
 - o Other devices have been developed for dogs, rodents, birds, even fishes.
 - Most studies using devices equipped with tactile interface were based on semi-automated approaches.
- Evans et al., 2008
 - Free access to testing area in which monkeys were isolated.
 - o Voluntary engagement could lead to greater motivation and better learning.
 - This method still required human intervention to manage subjects.
- Fagot & Paleressompoulle, 2009
 - Automatic ID of subjects via radio frequency ID system
 - Subjects were implanted with electronic chips in forearms
 - · Maintained in their social groups
 - Could freely and voluntarily access devices
 - Advantages:
 - Allows testing subjects in social group
 - Makes presence of experimenter unnecessary
 - Allows large volumes of data to be recorded
 - Allows study of both nonsocial and social cognitive skills
 - Fagot et al., 2014 have demonstrated positive effects of this approach on behavior and stress levels of NHPs in semi-free ranging conditions
 - · Cannot address all issues. Example: subject immobility
 - Can reduce stress linked to capture & physical restraint
 - Human time, costs of studies
- Three specifications

- e And Simplificity
- Remote control
- Easily adapted to conventional cages
- Resistant to typical environmental conditions & constraints of a primate housing facility
 - Physical shocks, dirt, dust, water spray
 - Remotely controllable
 - Equipped with two video cameras
 - Able to deliver two different solid food reward systems concurrently
- Experimental aim
 - Autonomously learn one or more tasks until stable baseline is reached, without any human intervention.
 - Reasons for using unconstrained animals:
 - Improve experimental conditions
 - Obtain large amount of data, on fewer animals
 - Reduce study costs by substantial reduction of training time and human cost
- Subjects
 - Four rhesus monkeys in mixed social group







Device

- Attached to front mesh of indoor enclosure
- Removed once a week for 1 hr to clean.
- Upper part of front side is made of transparent PVC.
- Only front part of device is available to subject
- Transparent PVC
- Two circular hand-ports
- Independent antenna
- One vertical infrared beam
- Real time detection of subject introducing a hand into a hand-port
 - Detects RFID chip implanted in forearm
- Front part also contains 15" touchscreen w/ speakers
- Rear part (unreachable by NHP) contains watertight box
- Top part contains all the remaining devices
- Apparatus connects to internet and normal power supple through two secured cables plugged into top of apparatus's back side
- Withstand temp & humidity variation, dirt, spray water, potential physical challenges by monkeys (physical impacts)
- Can work 24 h/d, 7 d/w

Software

- Set of software developed in-house controls the experimental device and manages study design and data recording
- Main Java program manages various peripheral components of the apparatus
- Permanently reads state of each input device and updates state of each output device
- Web Socket is used to permanently update the server about the state of the experimental device and each subject's progress.
- If an RFID tag is detected while device is vacant, program immediately receives information and examines corresponding subject's position on battery of tests, on the database
- If no problem is detected, generates task in real time.
- Choice of type of test & difficulty settings are calculated after each trial.
- Once a trial ends, data automatically sent to server's program and recorded on a database (MySQL).
- If a dispenser fails to distribute a pellet, the program automatically locks it for the remainder of the session.

- If another similar dispenser is available, it will be used automatically.
- o Otherwise, the device goes into "sleep mode".
- "Re-motivation" tasks
- Tasks:
 - 5-CSRT
 - DMS
 - SOSS

Conclusions/action items: Discuss w/ team

https://www.sciencedirect.com/science/article/pii/S1074742717301211?via%3Dihub

Andrew Dirkse - Oct 17, 2025, 4:26 PM CDT

Title: Notes on Truppa et al.

Date: 10/10/2025

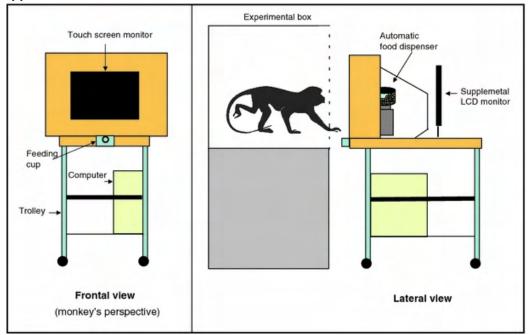
Content by: Andrew Dirkse

Goals: Understand design choices made by Truppa and colleagues.

Content:

- Studying abstract concepts including "identity"
- · Main two tasks:
 - Same/different (S/D)
 - Match-to-sample (MTS) task

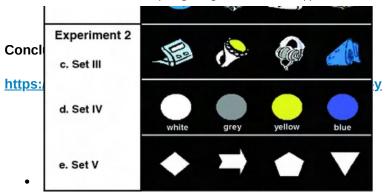
Apparatus



- o Personal computer connected to 19" touch screen and food dispenser
- E-Prime software as stimulus generator and served both to present stimuli and to record the response behavior
- Food: pellet to Plexiglass feeding cup located 16 cm below touch screen in centre.
- Mounted on top of a trolley (PC on bottom)
- Apparatus placed approx. 15 cm from grid of experimental cage
- Grid made of horizontal metal bars separated by 4.5 cm.
 - Subject stretches its arm through bars to touch stimuli upon screen

Stimuli





2025/09/09-Raspberry Pi Touchscreen

Andrew Dirkse - Sep 09, 2025, 9:34 PM CDT

Title: Raspberry Pi Touchscreen

Date: 9/9/2025

Content by: Andrew Dirkse

Goals: Personal research to better understand parameters of Raspberry Pi touchscreen and setup.

Content: https://www.raspberrypi.com/products/raspberry-pi-touch-display/

Official Raspberry Pi touchscreen

- 7 inches
- Active area ~154x86 mm
- Connects to Raspberry Pi through power from GPIO port and ribbon cable to DSI port.
- Does NOT work with Raspberry Pi 400/Zero.

https://datasheets.raspberrypi.com/display/7-inch-display-product-brief.pdf

Warnings

- Fragile display surface, can shatter.
- Enclosure must ensure that all parts of circuit board are inaccessible during operation.

Conclusions/action items:

- Raspberry Pi touchscreen may not be able to ensure monkey's safety.
- Touchscreen might shatter.
- More suitable touchscreen (i.e., rugged) should be found.



2025/09/10-Programming for the Touchscreen

Andrew Dirkse - Sep 14, 2025, 10:48 AM CDT

Title: Raspberry Pi Touchscreen Programming

Date: 9/10/2025

Content by: Andrew Dirkse

Goals: Individual research to understand the process of programming an app for the Raspberry Pi touchscreen.

Content:

- We will most likely be using Linux because that's what the lab uses (per meeting with David) and the device needs to be extensible.
- Graphical user interface (GUI) libraries (Monk 2016):
 - Tkinter
 - Most commonly used
 - Runs on Linux
 - Comes with Python (pre-installed on Raspberry Pi)
 - Pygame
 - Most commonly used for game development
 - Simpler than Tkinter for simple applications
 - · Writing to the SD card
 - Evdev allows you to read and write input events on Linux
 - Can write to text file on SD card using Python `open()` function

Conclusions/action items:

- Decide between Tkinter and Python
 - o Discuss what MVP GUI we want to design to test write function
 - Discuss whether we want to attempt access to Internet (though David isn't really looking for this)
 - o Obtain a Raspberry Pi

References:

Monk, S. 2016. Programming the Raspberry Pi: Getting Started with Python. McGraw-Hill Education.

Andrew Dirkse - Sep 18, 2025, 6:30 PM CDT

Title: FDA Regulations

Date: 9/12/2025

Content by: Andrew Dirkse

Goals: To better understand the various regulations that apply to our project since it will be used by a monkey.

- Animal Welfare Act (AWA)
 - Code of Federal Regulations (CFR) 3.75
 - "(c) Surfaces—
 - "(1) *General requirements.* The surfaces of housing facilities—including perches, shelves, swings, boxes, houses, dens, and other furniture-type fixtures or objects within the facility—must be constructed in a manner and made of materials that allow them to be readily cleaned and sanitized, or removed or replaced when worn or soiled. Furniture-type fixtures or objects must be sturdily constructed and must be strong enough to provide for the safe activity and welfare of nonhuman primates. Floors may be made of dirt, absorbent bedding, sand, gravel, grass, or other similar material that can be readily cleaned, or can be removed or replaced whenever cleaning does not eliminate odors, diseases, pests, insects, or vermin. Any surfaces that come in contact with nonhuman primates must:
 - "(i) Be free of excessive rust that prevents the required cleaning and sanitization, or that affects the structural strength of the surface; and
 - "(ii) Be free of jagged edges or sharp points that might injure the animals.
 - "(2) *Maintenance and replacement of surfaces.* All surfaces must be maintained on a regular basis. Surfaces of housing facilities—including houses, dens, and other furniture-type fixtures and objects within the facility—that cannot be readily cleaned and sanitized, must be replaced when worn or soiled.
 - "(3) *Cleaning.* Hard surfaces with which nonhuman primates come in contact must be spot-cleaned daily and sanitized in accordance with § 3.84 of this subpart to prevent accumulation of excreta or disease hazards. If the species scent mark, the surfaces must be sanitized or replaced at regular intervals as determined by the attending veterinarian in accordance with generally accepted professional and husbandry practices. Floors made of dirt, absorbent bedding, sand, gravel, grass, or other similar material, and planted enclosures must be raked or spot-cleaned with sufficient frequency to ensure all animals the freedom to avoid contact with excreta. Contaminated material must be removed or replaced whenever raking and spot cleaning does not eliminate odors, diseases, insects, pests, or vermin

infestation. All other surfaces of housing facilities must be cleaned and sanitized when necessary to satisfy generally accepted husbandry standards and practices. Sanitization may be done by any of the methods provided in § 3.84(b)(3) of this subpart for primary enclosures."

• CFR 3.81 (b) Environmental enrichment

"The physical environment in the primary enclosures must be enriched by providing means of expressing noninjurious species-typical activities. Species differences should be considered when determining the type or methods of enrichment. Examples of environmental enrichments include providing perches, swings, mirrors, and other increased cage complexities; providing objects to manipulate; varied food items; using foraging or task-oriented feeding methods; and providing interaction with the care giver or other familiar and knowledgeable person consistent with personnel safety precautions."

CFR 3.82 (a) and (b)

- "(a) The diet for nonhuman primates must be appropriate for the species, size, age, and condition of the animal, and for the conditions in which the nonhuman primate is maintained, according to generally accepted professional and husbandry practices and nutritional standards. The food must be clean, wholesome, and palatable to the animals. It must be of sufficient quantity and have sufficient nutritive value to maintain a healthful condition and weight range of the animal and to meet its normal daily nutritional requirements.
- "(b) Nonhuman primates must be fed at least once each day except as otherwise might be required to provide adequate veterinary care. Infant and juvenile nonhuman primates must be fed as often as necessary in accordance with generally accepted professional and husbandry practices and nutritional standards, based upon the animals' age and condition."

o CFR 3.89

- "(a) Each nonhuman primate that is 1 year of age or more must be offered food at least once every 24 hours. Each nonhuman primate that is less than 1 year of age must be offered food at least once every 12 hours. Each nonhuman primate must be offered potable water at least once every 12 hours. These time periods apply to dealers, exhibitors, and research facilities, including Federal research facilities, who transport nonhuman primates in their own primary conveyances, starting from the time the nonhuman primate was last offered food and potable water before transportation was begun. These time periods apply to carriers and intermediate handlers starting from the date and time stated on the certification provided under § 3.86(c) of this subpart. Each nonhuman primate must be offered food and potable water within 4 hours before being transported in commerce. Consignors who are subject to the Animal Welfare regulations (9 CFR parts 1, 2, and 3) must certify that each nonhuman primate was offered food and potable water within the 4 hours preceding delivery of the nonhuman primate to a carrier or intermediate handler for transportation in commerce, and must certify the date and time the food and potable water was offered, in accordance with § 3.86(c) of this subpart.
- "(b) Any dealer, exhibitor, or research facility, including a Federal research facility, offering a nonhuman primate to a carrier or intermediate handler for transportation in commerce must securely attach to the outside of the primary enclosure used for transporting the nonhuman primate, written instructions for a 24-hour period for the in-transit food and water requirements of the nonhuman primate(s) contained in the

- enclosure. The instructions must be attached in a manner that makes them easily noticed and read.
- "(c) Food and water receptacles must be securely attached inside the primary enclosure and placed so that the receptacles can be filled from outside of the enclosure without opening the door. Food and water receptacles must be designed, constructed, and installed so that a nonhuman primate cannot leave the primary enclosure through the food or water opening."
- · Protocol for IACUC
 - o (d) IACUC review of activities involving animals.
 - "(1) In order to approve proposed activities or proposed significant changes in ongoing activities, the IACUC shall conduct a review of those components of the activities related to the care and use of animals and determine that the proposed activities are in accordance with this subchapter unless acceptable justification for a departure is presented in writing; *Provided, however,* That field studies as defined in <u>part 1 of this subchapter</u> are exempt from this requirement. Further, the IACUC shall determine that the proposed activities or significant changes in ongoing activities meet the following requirements:
 - (i) Procedures involving animals will avoid or minimize discomfort, distress, and pain to the animals;
 - (ii) The principal investigator has considered alternatives to procedures that may cause more than momentary or slight pain or distress to the animals, and has provided a written narrative description of the methods and sources, *e. g.*, the Animal Welfare Information Center, used to determine that alternatives were not available;
 - (iii) The principal investigator has provided written assurance that the activities do not unnecessarily duplicate previous experiments;
 - (iv) Procedures that may cause more than momentary or slight pain or distress to the animals will:
 - (A) Be performed with appropriate sedatives, analgesics or anesthetics, unless withholding such agents is justified for scientific reasons, in writing, by the principal investigator and will continue for only the necessary period of time;
 - (B) Involve, in their planning, consultation with the attending veterinarian or his or her designee;
 - (C) Not include the use of paralytics without anesthesia;
 - (v) Animals that would otherwise experience severe or chronic pain or distress that cannot be relieved will be painlessly euthanized at the end of the procedure or, if appropriate, during the procedure;
 - (vi) The animals' living conditions will be appropriate for their species in accordance with part 3 of this subchapter, and contribute to their health and comfort. The housing, feeding, and nonmedical care of the animals will be directed by the attending veterinarian or other scientist trained and experienced in the proper care, handling, and use of the species being maintained or studied;

- (vii) Medical care for animals will be available and provided as necessary by a qualified veterinarian;
- (viii) Personnel conducting procedures on the species being maintained or studied will be appropriately qualified and trained in those procedures; [...]"

Conclusions/action items:

- Determine whether fluid restriction is being used in the lab
- Meet with advisor/Puccinelli to determine other places to look for regulations (*Guide for Care and Use of Laboratory Animals?*)

References:

https://www.ecfr.gov/current/title-9/section-3.81

Andrew Dirkse - Oct 31, 2025, 8:53 AM CDT

Title: Basic Electronics for Scientists and Engineers, Denis L. Eggleston

Date: 10/31/2025

Content by: Andrew Dirkse

Goals: As a 200 coming late into the BME program, I feel my knowledge of basic electronics is lacking. Therefore, I chose the book *Basic Electronics for Scientists and Engineers* by Eggleston in order to gain the prerequisite knowledge to speak intelligently on electronics and contribute to our team. Below, I aim to list the topics I have covered in the book so far.

Content:

- Ch. 1
 - KCL and KVL
 - Power, formulas
 - Resistance and resistivity
 - Equivalent resistance (series & parallel)
 - o Thevenin's and Norton's theorems
 - Applications of resistors
 - Current limiting
 - Voltage divider
 - Current divider
 - Multi-range analog voltmeter/ammeter (shunt resistor)

Conclusions/action items: Read more of the book, keeping this page updated.

Andrew Dirkse - Nov 07, 2025, 11:02 AM CST

Title: McMahon: Circuit Analysis Demystified

Date: 11/07/2025

Content by: Andrew Dirkse

Goals: Write about what I have been learning from the book, "Circuit Analysis Demystified", by David McMahon.

Content:

- Kirchhoff's laws (KCL and KVL)
- Thevenin and Norton theorems
- Capacitance and Inductance (series, parallel)
- · Phasor analysis
- · Frequency response

Conclusions/action items: Read more of the book for next week: op-amps, network theorems

Andrew Dirkse - Sep 21, 2025, 9:20 PM CDT

Title: DMTS Task Prototype Code

Date: 9/21/2025

Content by: Andrew Dirkse

Goals: Code a sample prototype task to appear on the touchscreen for a monkey. Delayed Match-to-Sample (DMTS).

Content:

Pseudocode:

- 1. Show a random "correct" image from the `images` folder.
- 2. When image clicked, do a 1000 ms delay and then show the correct image side-by-side with a different, "incorrect" image.
- 3. If correct image clicked, show "Correct!" for 1000 ms, then go back to 1.
- 4. If incorrect image clicked, show "Incorrect!" for 1000 ms, then go back to 1.

Full Code:

import tkinter as tk

from PIL import Image, ImageTk

import random

import os

IMAGE_FOLDER = "images"

WINDOW WIDTH = 600

WINDOW_HEIGHT = 400

SQUARE_SIZE = 200 # final size for every image (square)

def make_square(img: Image.Image, size: int) -> Image.Image:

.....

Scale and center-crop image so it exactly fills a size x size square.

Returns an RGBA PIL.Image (preserves alpha when available).

```
11111
```

```
img = img.convert("RGBA") # preserves alpha if present, otherwise opaque
  # scale so the image covers the square (no letterbox)
  ratio = max(size / img.width, size / img.height)
  new_size = (int(img.width * ratio), int(img.height * ratio))
  img = img.resize(new size, Image.Resampling.LANCZOS)
  # center-crop to desired size
  left = (img.width - size) // 2
  top = (img.height - size) // 2
  img = img.crop((left, top, left + size, top + size))
  return img
class ImageQuiz:
  def __init__(self, root):
    self.root = root
    self.root.title("Image Quiz")
    self.center_window(WINDOW_WIDTH, WINDOW_HEIGHT)
    # Main frame using the root's background color (so transparency blends)
    bg = root.cget("bg")
    self.main_frame = tk.Frame(root, width=WINDOW_WIDTH, height=WINDOW_HEIGHT, bg=bg)
    self.main frame.pack(expand=True, fill="both")
    self.result_label = tk.Label(self.main_frame, text="", font=("Arial", 24), bg=bg)
    self.result label.place(relx=0.5, rely=0.5, anchor="center")
```

```
# Get image file paths
  valid_ext = (".png", ".jpg", ".jpeg", ".gif", ".bmp", ".webp")
  file_list = [
     os.path.join(IMAGE_FOLDER, f)
     for f in os.listdir(IMAGE_FOLDER)
    if f.lower().endswith(valid_ext)
  ]
  if not file_list:
     raise RuntimeError(f"No images found in folder: {IMAGE_FOLDER}")
  # Load and normalize images (square, same size)
  self.images = []
  for path in file_list:
     try:
       pil = Image.open(path)
       pil = make_square(pil, SQUARE_SIZE)
       tk_img = ImageTk.PhotoImage(pil)
       self.images.append(tk_img)
     except Exception as e:
       print(f"Skipping {path}: {e}")
  if not self.images:
     raise RuntimeError("No valid images could be loaded.")
  self.show_image()
def center_window(self, w, h):
  screen_w = self.root.winfo_screenwidth()
  screen_h = self.root.winfo_screenheight()
```

```
x = int((screen_w / 2) - (w / 2))
  y = int((screen_h / 2) - (h / 2))
  self.root.geometry(f"\{w\}x\{h\}+\{x\}+\{y\}")
def show_image(self):
  """Show single stimulus until clicked."""
  self.correct index = random.randrange(len(self.images))
  img = self.images[self.correct_index]
  self.clear_content()
  # Stimulus as clickable button
  btn = tk.Button(
     self.main_frame,
     image=img,
     bd=0,
                      # no border
     highlightthickness=0, # remove highlight border
     relief="flat",
                      # flat appearance
     bg=self.main_frame.cget("bg"),
     activebackground=self.main_frame.cget("bg"), # keeps background same when pressed
     activeforeground=self.main_frame.cget("bg"), # if text is present
     overrelief="flat", # ensure mouse-over doesn't change relief
     command=self.stimulus clicked
  )
  btn.image = img
  btn.place(relx=0.5, rely=0.5, anchor="center")
def stimulus clicked(self):
```

```
"""Handle stimulus click: remove stimulus, wait 1000 ms, show choices."""
  self.clear_content()
  # Wait 1000 ms before showing the two choices
  self.root.after(1000, self.show choices)
def clear_stimulus_then_wait(self):
  """Clear single image, then wait 500 ms before showing choices."""
  self.clear_content()
  self.root.after(500, self.show choices)
def show_choices(self):
  """Show two choices (correct + random wrong), centered side by side."""
  for w in list(self.main_frame.winfo_children()):
    if w is not self.result_label:
       w.destroy()
  wrong_indices = list(range(len(self.images)))
  wrong_indices.remove(self.correct_index)
  wrong_index = random.choice(wrong_indices)
  options = [
     (self.images[self.correct_index], True),
     (self.images[wrong index], False),
  ]
  random.shuffle(options)
  choice_frame = tk.Frame(self.main_frame, bg=self.main_frame.cget("bg"))
  choice frame.place(relx=0.5, rely=0.5, anchor="center")
```

```
for img, is_correct in options:
     btn = tk.Button(
       choice_frame,
       image=img,
       command=lambda c=is_correct: self.show_result(c),
       bd=0,
       highlightthickness=0,
       relief="flat",
     )
     btn.image = img
     btn.pack(side="left", padx=20)
def show_result(self, correct):
  """Show result and then go to next round."""
  for w in list(self.main_frame.winfo_children()):
     if w is not self.result_label:
       w.destroy()
  if correct:
     self.result_label.config(text="Correct!", fg="green")
  else:
     self.result_label.config(text="Incorrect!", fg="red")
  self.root.after(2000, self.show_image)
def clear content(self):
  """Remove everything except the result label."""
  for widget in self.main_frame.winfo_children():
     if widget != self.result label:
```

```
widget.destroy()
```

self.result_label.config(text="")

```
if __name__ == "__main__":
  root = tk.Tk()
  app = ImageQuiz(root)
  root.mainloop()
```

Conclusions/action items: Examine the code for extensibility and comprehensibility.

Andrew Dirkse - Sep 26, 2025, 11:03 AM CDT

Title: Match-to-Sample Task Code Update

Date: 9/26/2025

Content by: Andrew Dirkse

Goals: Describe changes to the MTS task code.

Content:

Conclusions/action items:

Andrew Dirkse - Oct 17, 2025, 10:08 AM CDT

Title: Documentation of Match-to-Sample (MTS) Task Code

Date: 10/17/2025

Content by: Andrew Dirkse

Goals: Explain how the MTS code works in accordance with peer feedback received.

- Line numbers refer to file MTSApp.py.
- Lines 1-4: Import necessary libraries
 - o tkinter: standard library binding to Tcl/Tk interface
 - PIL (Pillow): to handle image formats not supported by tkinter, including BMP, which is what is currently used
 - Image: image object; ImageTk: Tk-compatible image
 - o random: required for random selection of stimulus and alternative
 - os: required to access the image folder
- Lines 7-10: definition of constants
 - Image folder is called "images"
 - Final dimensions of window are 400 x 600
 - Each image is a square and dimensions are 200 by 200
- Lines 13-28: make square()
 - Conversion to RGBA (line 18) preserves alpha (opacity channel)
 - Resizes image to fill 200 x 200 square
 - Center-crops image to desired size
- Lines 32-70: ImageQuiz. init ()
 - o Gives the task a title
 - Centers the window using the given dimensions and mainframe
 - Load images from folder and normalize them
- Lines 79-101: ImageQuiz.show_image()
 - · Choose a random image
 - · Show image as clickable button
- Lines 103-107: ImageQuiz.stimulus_clicked()
 - When button is clicked, remove stimulus, wait 1000 ms, show choices.
- Lines 109-138: ImageQuiz.show_choices()
 - Randomly choose one "wrong" image (alternative) and display stimulus and alternative, centered
 in the window.
- Lines 140-151: ImageQuiz.show result()
 - If correct choice made, display, "Correct!" in green, else "Incorrect!" in red.
 - This will connect to the Raspberry Pi and output a signal in the final product; this is a placeholder technology
- Lines 153-158: ImageQuiz.clear_content()
 - Remove everything except the result label.

Conclusions/action items: Discuss with team to see if the explanation is understandable to them. Refactor code to remove unused functions or unnecessary calls.

2025/10/17-Biosafety & OSHA Required Training

Andrew Dirkse - Nov 01, 2025, 12:42 PM CDT

Title: Documentation of Biosafety Required Training and OSHA

Date: 10/17/2025

Content by: Andrew Dirkse

Goals: Verify that I completed my Biosafety Training and Chemical Safety: OSHA Lab Standard on 6/22/25 and

11/12/24.

Content:



This certifies that Andrew Dirkse has completed training for the following course(s):

Course	Assignment	Completion	Expiration
2024-2025 HIPAA Privacy & Security Training	2024-2025 HIPAA Privacy & Security Training	12/4/2024	
Biosafety Required Training	Biosafety Required Training Quiz 2024-2025	6/22/2025	6/22/2030
Chemical Safety: Cryogen Safety Training	Part 1 Final Quiz	12/4/2024	12/4/2029
Chemical Safety: Cryogen Safety Training	Part 2 Final Quiz	12/4/2024	12/4/2029
Chemical Safety: Fume Hood Safety Training	Fume Hood Final Quiz	12/10/2024	12/10/2029
Chemical Safety: Hazard Communication - Identifying Chemical Hazards	Final Quiz	12/10/2024	12/10/2029
Chemical Safety: The OSHA Lab Standard	Final Quiz	11/12/2024	
Disposing of Hazardous Chemicals	Final Quiz	12/10/2024	12/10/2029
Environmental & Occupational Health	Animal Contact Risk Questionnaire	12/6/2024	12/6/2025
Risk Communication in Animal Facilities	Risk Communication in Animal Facilities Quiz 2024	12/6/2024	12/6/2027
Safety for Personnel with Animal Contact	Animal Contact Personnel Quiz 2024	5/6/2024	5/6/2029

Data Last Imported: 10/24/2025 11:23 AM

Conclusions/action items: Continue training (Machining).

Andrew Dirkse - Nov 01, 2025, 12:42 PM CDT

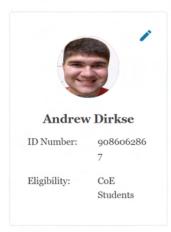
Title: Intro to Machining Certification

Date: 10/24/2025

Content by: Andrew Dirkse

Goals: Certify completion of Intro to Machining

Content:



My Memberships				
Membership Type	Start Date	Expiry Date	Renew	Card Info
Machining	Wed, Aug 20 2025	Permanent	Not Renewable	N/A
Lab Orientation	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A
Shop Tools	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A

Profile
Program Registrations
Bookings
Memberships
Orders
Invoices

Conclusions/action items: N/A

Andrew Dirkse - Nov 03, 2025, 1:31 PM CST

Title: Client Meeting

Date: 11/3/25

Content by: Andrew Dirkse

Present: Kalob, Charlie, Jackson, Dr. Herzfeld

Goals: Take notes on meeting.

Content:

- How did show and tell go?
- Went well, main question is, how are we going to attach, and what material?
- · Could do benders at ECB, but everyone seemed to discourage us from that
- Anything else to order?
 - Most stuff at makerspace is cheap
 - Sameer/Kalob working on CAD.
 - o Printed from PLA, have by next week
- How to step down voltage?
 - o Touchscreen comes with own power cable
 - Raspberry Pi uses microUSB
 - Put 110-V in needs to be safe.
 - Enough time: compact.
 - o Cart would be a great idea
 - Urine not a huge issue. They can pee far but not THAT far
 - o Cart with a box.
 - Have all of that away from the monkey. Don't need to worry about water-proofing.
 - They have carts
 - Make a casing to hold electronics, tubing possibly buy through Grainger.
- Testing w/ electronics
 - 15 ms
 - Look in repository schematic. ms/mL
 - It can be titrated
 - As long as we can change length of pulse... As long as configurable
 - Can vary based on monkey, how long they've been training.
 - Typically consume 300-400 ml juice/day,

Conclusions/action items:

Have completed PLA print for next meeting

Meet to discuss power supply

Casing & holding for electronics by next week.

Andrew Dirkse - Nov 24, 2025, 1:23 PM CST

Title: Advisor Meeting

Date: 11/24/25

Content by: Andrew Dirkse

Present: David Herzfeld (client), Jackson

Goals: Discuss power supply, presentation date and getting time changed so that David can attend

Content:

• Presentation: move earlier, to 12:30?

o Will contact Dr. P., let you know

- · Printed mode of case
 - o Dims off a little bit
- Pump ordered, unsure if will come by Wed.
- Don't break it, but OK to apply power to it
- Deliverables (final), final report Dec. 10.

Conclusions/action items: Watch for pump, touch base with Logan abt. second pump

Andrew Dirkse - Oct 01, 2025, 10:49 PM CDT

Title: Advisor Meeting #3

Date: 9/26/2025

Content by: Andrew Dirkse

Goals: Personal notes/guidelines to guide my work for next week.

Content:

- PDS: Thomas comparison, notification system?
- Inform client about presentation on Friday and final poster session. (Reminders)
- · Professional Attire
 - o Upload link to Google Slides, Office 365, etc. to Canvas
 - Upload PDF slides
- · Show and tell?
- Locking mechanism?
 - Cardboard "prototype"?
- Touchscreen
 - o Get ordering... ditto Raspberry Pi

Conclusions/action items:

Andrew Dirkse - Oct 31, 2025, 8:58 AM CDT

Title: Meeting w/ Logan

Date: 10/23/2025

Content by: Andrew Dirkse

Goals: Record details of meeting with Logan

Content:

- Main goal: to integrate hardware and software.
- Logan will give me a function to put in my code when a "Correct" answer is pressed that will send a signal to the pump to dispense the reward.
- Main issue: power supply. How to get it from the wall, and different components take different currents/voltages.
 - Research
- We will first test on a computer monitor until the screen arrives (not for a while, predicted).
 - Update 10/27: came early! Thank you Sam Walton:)

Conclusions/action items: Research how to reduce voltage from outlet to components. Meet again w/ Logan to gauge progress on figuring out power supply.

Andrew Dirkse - Nov 06, 2025, 6:45 PM CST

Title: Meeting w/ Logan

Date: 11/06/2025

Content by: Andrew Dirkse

Present: Logan

Goals: Work with the circuitry and get updated on how the circuitry is coming along. Taking notes on meeting

- USB for touchscreen, otherwise can't get any input.
- All enclosed in the box, is the idea.
- 24V/2A converter
- Single power strip is the plan eventually
- Regular power cable (green) w/ adapter
- · Connect a cord
- · Red and yellow wires in motor controller
- Use screwdriver to loosen cable
- Insert wire then clamp down (screwdriver)
- Didn't work first time: pins weren't connected.
- Second time: pump tried to work.
 - o Cables were hot.
 - Takes a lot more current to activate pump when there's a tube in it because of how hard the tube is.
- Try 3: w/out pump. Hooked up to Logan's PC.
 - o Still tries but doesn't move.
- · Turned on oscilloscope
- Ground everything first when high voltage.
- 27 V, 2,000 Hz Signal looks good but no output.
 - There shouldn't be a delay
 - o Maybe we're overloading it.
- 27 V 60 Hz after fixing code
 - Motor still not spinning
- Troubleshooting
 - Is motor busted? (Or wall input?)
 - Power it directly
 - Electronics is 90% troubleshooting
 - Negative to negative and positive to positive
 - Plug in directly to wall -> no turn.
 - o Solution: buy different adapter? Not until we know we need it
 - Idea: intertwine wires from wall & oscilloscope.
 - No luck. Oscilloscope gives 5 volts, fluctuating signal. Want 4 V!
 - We're getting 24 volts. As we wanted (Offset)

• Amp problem or motor problem.

Conclusions/action items: Problem with amps or motor.

Andrew Dirkse - Nov 07, 2025, 12:58 PM CST

Title: Tong Distinguished Lecture Kristin Myers (Class 2002)

Building a Career of Impact: Why Healthcare Needs More Engineers

Date: 11/07/2025

Content by: Andrew Dirkse

Goals: Take notes on Myers' journey

- · Alum of UW Madison
 - MBA at Harvard, '07
 - Swim team at UW
 - Job grading papers, nannying, tutoring
 - Medtronic
 - Four internships and co-ops
 - Abiomed (artificial heart), Baird, GAP, Guidant (now part of Boston Scientific)
- 30 people per class when she was in school...
- Find your grade on top of Bascom Hill
- Run toward the hard problems, because they are what changes the world.
- Three "chapters":
 - Foundation
 - Growth Curve
 - Build & Transform
- California, working in venture capital (Skyline Ventures)
- Arboretum Ventures (Mich.)
 - Investor in healthcare startup technology
- Chapter 1: how to be a good engineer... file patents, get your head around a project and get it done.
 - · Aetna, later part of CVS Health
 - Chief of Staff to CEO, President, Great Lakes Region
 - Unified Women's Healthcare, Pres. & COO
 - Cycling studio
 - COVID-19 Pandemic telemed, furlough 50% of workforce, explain to doctors why it was necessary to wear masks
 - "Combining IQ with EQ"
- Chapter 3: driving system-level impact through innovation & scale
 - Rural geographies
 - How to make it so that healthcare is affordable, accessible, and has good outcomes & better patient experience
 - You don't need to know your final destination just follow hard problems and build skills that allow you to make an impact
 - [You shape your experiences just as much as they shape you A.D.]
- Quadruple aim:
 - Improved provider experience

- Improved provider experience
 Improved patient outcomes
- Improved patient experience
- Lower cost of care
- Ask a doctor: "If you could go back into medicine, would you do so?" 50% say no
- How much do we spend on healthcare in the US?
 - Twice as much as other OECD countries
 - o Outcomes, cost, quality, provider experience?
 - Ranked last on equity, access & outcomes
 - Complicated: 1.2 trillion dollars wasted
 - Misaligned incentives
 - Legacy IT & infrastructure
 - Inequities
 - Fee-for-service
 - Patent system
- Every broken system is an invitation for someone brave to fix it.
 - Not because people don't care; it was never designed to be one system.
 - Future of healthcare is an integrated ecosystem of health and care.
- · What we need
 - interoperable data infrastructure
 - human centered design
 - aligned incentives and measurement
 - connected care delivery platforms
 - o simplified and automated infrastructure
 - systems thinking
 - analytical rigor
 - o design & iteration
 - process optimization
 - reliability & safety
 - Healthcare needs better systems. And systems are what engineers build best.
- 1. Work hard & build range
 - Take on the hardest projects, classes and experiences you can find. Effort and range are your foundation.
 - Came from a not good home situation, parents addicted to alcohol
 - Work in person, helpful to get a sense of personality
- 2. Seek diverse exposure
 - Explore different sectors, teams and geographies.
 - Gain perspective and learn how systems connect, not just how parts work.
 - Was a Systems Engineer at Medtronic
 - o Doing different jobs was helpful
- 3. Choose your people wisely
 - You are defined by the 5 people you hang out with most
 - Surround yourself with curious, drive, high-integrity people. They will shape who you become
- 4. Know your values and protect them
 - o Define what matters most family/friends, health, career/impact, values
 - And make decisions that align.
 - K.M. chose people that were calm (husband). Sleep 8 hrs!
- 5. Embrace challenge and keep growing!
 - Run toward hard problems

- Growth lives on the edge of discomfort, where big impact starts.
- You've already made it further than most people in this country will ever have a dream of, or access to, or resources for
- Approaching a career with fear, or with opportunity?
- You never escape the feeling of, "Will I make it?"
- You can't go wrong.

Questions

- How to manage feelings of burnout?
 - Energy flows, different times of day best for doing different things
 - o Gym at 6 am
 - Block calendar
 - Take a break
 - Know when to say "No"
 - If it was tomorrow, would you say "Yes"?
- Isn't part of the reason the system stays broken because of the profits?
 - That's part of the misguided incentive
 - · Accessing your health record
 - Big grant for rural healthcare... behind the scenes, state funding was cut so they're trying to bring in federal money
 - Transparency in data.
- What's the experience you regret the least?
 - Family
 - · Going to business school
 - Deconstruct something & put it back together
 - Engineering as well as business

Conclusions/action items: kristin.myers@gmail.com

Andrew Dirkse - Sep 12, 2025, 12:05 PM CDT

Title: First BSAC Meeting

Date: 9/12/2025

Content by: Andrew Dirkse

Goals: Record a summary of the first BSAC meeting as the BSAC for the group.

- Jose Ramirez, chair
- Meetings are every other Friday, 11:00-11:50 am in Eng. Hall 2317
- Get involved with BMES: 9/17 fall kickoff, 6-7 pm Camp Randall
- BSAC = Biomedical Student Advisory Committee
 - Provide feedback about BME curriculum/design
 - Example: changing credits to 2/3, up from 1.
- · Discussion reminders
 - Actively listen to peers
 - Respect differing opinions
 - Encourage all to engage
 - Feel free to go off-prompt
 - Pick one person to share a summary of the small-group discussion with the large group
- · "Training throughout the curriculum"
- We split into groups and introduced ourselves
 - Jonathan, Joseph, Nathan, Sawyer (400).
- Thoughts on "TTTC"?
 - Can be overwhelming for a transfer student to be dropped into Engr design AND have to do this training.
 - Poorly communicated. Mentioned for ~3 sec. at opening meeting
 - 201 is more structured. Homework. Graded. Clear expectations, laid out on Canvas.
 - Everything needed in 200 is taught in 201
 - Opportunity for 300s to mentor, take leadership
 - No one's a natural teacher. (Except Joseph)
- Thoughts about BSAC?
 - Good for 200s especially if you're bioinstrumentation
 - · Lack of participation in BMES?
- Would tell future BME: don't do Biocore.
 - o Conflicts with 330, 510
 - Fewer sections for higher level courses
 - Seasonally offered courses (only in Fall or Spring)
- Project selection?
 - Suggestion: sort by number of proposals and list proposals by class
- Advice you wish you had as a 200
 - Do your LabArchives
 - To instructors: explicitly state expectations regarding quantity of LabArchives

Conclusions/action items:

Andrew Dirkse - Sep 19, 2025, 11:49 AM CDT

Title: BSAC Meeting #2

Date: 9/19/25

Content by: Andrew Dirkse

Present: BSAC executive committee

Goals: Note minutes of BSAC meeting for future reference and to keep other members of group informed.

- · Training through the curriculum
 - Unclear what it referred to (but I knew that I had to do these trainings)
 - What goes in the Training Documentation folder?
- · Redesigning website
 - · Group of BSACs work on it?
 - Project selection page designed ~7 (?) years ago by a BME student
- How many notebooks?
 - o 3 credits: 6 hours/week outside class, should be reflected in notebook
 - Problem: some weeks there's more to do than others.
 - Lab notebook is where the work is recorded, not something that is filled out X times a week in exchange for a grade
- · Put out course lists earlier.
 - When you meet progression as a BME, you are forwarded the list
 - But it's sent out in summer, should it be forwarded again in fall?
- About BME 200
 - · Lecture?
 - Would make it 3 credits
 - One at beginning of semester?
 - To give the course more structure, explain expectations for notebooks
- · What is a project?
 - Project proposal
 - Motivation
 - Why it's a good fit for you
 - Wednesday before selection, you get an email stating whether you got your proposal or your second choice
- Questions for Faculty (next meeting, 9/26):
- · Course advising
 - How early? Multiple emails?
- More explanation of what "training through the curriculum" is
- Everyone in the room had met with their client
 - o PDS: problems in past where they couldn't meet with their client before PDS was due

- Differences between advisors and their grading systems (some more strict, others more lenient)
- Meetings with advisors during class time?
- One client with multiple accepted projects?
 - How are advisors allocated in this scenario?
 - It would be nice to have an advisor that has experience in the area of your project.

Conclusions/action items:

- Meet with faculty next week at regular meeting and bring up the above questions.
- Relate what was proposed to client with other members of group today to keep them up to date.

2025/09/26-BSAC Meeting #3 (w/ Faculty)

Andrew Dirkse - Sep 26, 2025, 11:50 AM CDT

Title: BSAC Meeting #3 w/ Faculty

Date: 9/26/2025

Content by: Andrew Dirkse

Goals: Record notes from meeting w/ faculty discussing curriculum.

Content:

- · Introductions from faculty
- · Reminders for active discussion
- Problems submitting the PDS?
 - o Couldn't find the PDS until 20 min. before it was due
 - o Client gave too specific of a design, which pigeonholed the 200s while writing the PDS
 - · Client didn't know what they wanted
 - o Client didn't meet until 2 days before it was due, advisor was gone too
- State of the project? Design matrix?
 - Didn't know what they were supposed to be drawing
 - Progressing at a good rate, meeting w/ client, circuitry done, starting CAD of mechanical parts
- LabArchive advisor expectations?
 - He is acting as our "manager", things were rough first week establishing expectations but better this week
 - Like GitHub: "Commit early, commit often"
 - Our advisor asked us if we knew what he was supposed to expect of us
 - Our advisor didn't show up on the scheduled Zoom meeting
- Order in which CAD courses are taken? CAD pretty much required for 201.
 - CAD a useful tool in general. Take in course, not have to do on own, more helpful, more support
- · Lab Notebook
 - Should advisor and student write an agreement at the first meeting?
 - The weekly check-ins guide the conversation.
 - "Shouldn't look like 4th grade science project"
 - o Go back to team, you are the "representatives" of the curriculum

Conclusions/action items: Discuss notes with group (esp. 200s) and ask if they have anything I should bring up the next meeting (10/3).

Andrew Dirkse - Oct 03, 2025, 3:50 PM CDT

Title: Executive BSAC Meeting

Date: 10/3/2025

Content by: Andrew Dirkse

Goals: Take notes on Executive BSAC meeting (training through the curriculum)

Content:

- Training through the curriculum form
 - Activity must take 90+ minutes
- Show and tell?
 - Prototype on Halloween
- Hearing back from mentees?
 - Scheduled, cancelled, followed up?

Conclusions/action items: Ask team whether there is anything to bring up at next meeting.

Andrew Dirkse - Oct 10, 2025, 1:02 PM CDT

Title: BSAC Meeting #5

Date: 10/10/25

Content by: Andrew

Goals: Record notes from BSAC Meeting

Content:

• Project Selection Website

- o Too robust for modification.
- Limited by DoIT (free & secure).

Adding Lecture

- o Dr. P. open to this idea.
- When to do it?
- Where to take 1 credit?
- Monday/Wednesday?

• Preset meeting w/ client at beginning?

- Logistical nightmare.
- Good lesson in expedient communication

· Advisor matching

- New faculty pick first?
- Small group discussion
 - Preliminary presentations good.
 - Advisors didn't ask questions thought that was weird
 - One group client already had a prototype and just wanted to improve on it and patent it
 - Some rooms went way over, leaving last groups with little time
 - Advisors need to control the length of presentations to ensure fairness
 - Call on groups to pose questions
 - o Preliminary report good
 - Got an extension
 - Some wait until "8 pm night it's due"
 - Push back until Friday? Push back feedback too?
 - More clarity in expectations for Discussion section.

Andrew Dirkse - Oct 17, 2025, 11:22 AM CDT

Title: BSAC Meeting #5

Date: 10/17/2025

Content by: Andrew Dirkse

Present: BSAC Exec Committee

Goals: Record notes from meeting and make available for advisor/teammates.

Content:

- Make "flowchart" for course progressions.
 - o e.g., you need two "levels" of prereqs (ECE 230 and 340 for BME 462)
- How is the mentorship program going?
 - Ghosting of mentors by mentees is a problem.
- Puccinelli responses to student feedback:
 - Report deadline will stay same. FBF deadline changed to Wednesday due to student feedback.
 - Leadership talk on Wednesday before draft Friday (good & planned).
 - 201 and 200 cannot swap!
 - Mentorship emphasis
 - Students admitted in Jan. would be cooked.
 - Harder to get 70+ projects over winter break.
- Meeting w/ Faculty topics to bring up:
 - Simplified flowchart
 - BME Mentor feedback
 - Show and tell
 - Advisor help
 - Questions about course enrollment
 - Courses visible on course search and enroll
 - Class selection soon

Andrew Dirkse - Oct 24, 2025, 11:47 AM CDT

Title: BSAC Meeting #7 w/ Faculty

Date: 10/24/25

Content by: Andrew Dirkse

Goals:

Content:

- In a group of mostly sophomores w/ a few juniors
- How is show and tell going? Prototyping?
 - o Going well, using cheaper/easier to fabricate materials first
 - No real issues w/ materials
- Training through the curriculum?
 - Almost done or already done.
- Testing?
 - Power?
 - Safe for monkey
 - · Amount of juice?
- · Questions about enrollment?
 - o Pre-regs; e.g., biology for cell & tissue engineering
- Pucc: Funds for someone in our department to do the ordering and then we college budgets from our clients on the submission forms.
- How can software dev groups prototype and demonstrate their product?
- Testing?

Andrew Dirkse - Nov 07, 2025, 4:36 PM CST

Title: BSAC Meeting #8

Date: 11/07/2025

Content by: Andrew Dirkse

Goals: Record notes from BSAC Meeting

Content:

- · Talk w/ Puccinelli
 - Yes, a client budget is submitted & reviewed.
 - NOT made public because we don't want students to be drawn to the project w/ the largest budget.
 - Report deadline will stay same.
 - FBF deadline changed to wednesday.
 - · Leadership talk on wed before draft friday.
 - 201 and 200 cannot swap
 - Students admitted in January would be cooked.
 - Mentorship emphasis.
 - Harder to get 70+ projects.
- Training thru curriculum?
 - Human subjects expires in less than 3 years
 - Probably won't be doing HS research in 3 yrs.
 - Finalized form for TTC.
- How did show and tell go
 - Feedback is hard to give (we were a software-heavy project)
 - o Advisors should pick projects he is more familiar with, that should make SAT more useful.
 - That didn't really happen with our advisor...:(
 - Vitamin D needle, stems & atrial things, biomaterials.
 - I don't know anything abt. biomaterials.
 - How to get resources. Still research. People didn't have an answer.
 - "Model" physical or AI model? Some confusion on the hardware vs. software aspect.
 - What doing this/next week?
 - Working on protocol.
 - Working on code to segment images.
 - Communication issues.
 - · Course enrollment?
 - BME 325 (Stats for BMEs)
 - Anxiety over being able to graduate on time b/c of courses filling up.
 - Recommendation: complete prototype before Thanksgiving.
 - Bioinst. Phys 202 -> ECE 230 -> ECE 340 -> BME 462 (medical instrumentation)

Andrew Dirkse - Nov 21, 2025, 11:37 AM CST

Title: BSAC Meeting #10 (Last BSAC Meeting w/ Faculty)

Date: 11/21/2025

Content by: Andrew Dirkse

Present: BSACs

Goals: Record notes from meeting

Content:

- · Previously asked BSAC Q's
 - Mentee not having access to BME advising page
 - intranet.engineering.wisc.edu/biomedical-engineering/current-student-resources/
 - CITI training
 - Gives teams the chance to have an IRB submitted and do actual systematic and generalizable testing
- · Rest of semester plans
 - Starting (rudimentary) construction
 - Testing
 - o Get started on presentation
 - Problems w/ Makerspace staff not knowing how to do the spreadsheets
 - Problems w/ clients (surgeons) not being available
 - o Problems w/ ECE enrollment (wait till Dec. 1st)
 - o Problems w/ professors' teaching
- · Large group
 - Juniors: don't forget about your sophomores!
 - Testing this week
 - Enrollment: be patient
 - There will be a Feedback Fruits assignment to review other people's posters. It will be on Canvas.
 - There will be Pizza!

Conclusions/action items: Attend next BSAC meeting in 2 weeks

Research - Article: Home-Cage Training for NHPs

Jackson STEWART - Sep 09, 2025, 9:46 PM CDT

Title: Home-Cage Training for Non-Human Primates: An Opportunity to Reduce Stress and Study Natural Behavior in Neurophysiology Experiments

Date: 09/09/2025

Content by: Jackson Stewart

Goals:

- Learn more about how Home-Cage Training Systems help with testing for NHPs.
- Learn about other designs for Home-Cage Training Systems.

Content:

- The research of NHPs helps us better understand the cognitive functions of people, but the testing
 environment can cause unnecessary stress for the animal that can harm their welfare and the validity of the
 experiment.
- Home-cage training allows the animals to participate in training in their "home environment". It also
 decreases the amount of exposure the animals have to people and the stress created when they are
 restrained.
- Increases quality and ethical standards of neuroscience research.
- The NHPs need to be in ideal physical and psychological health for the experiments to be valid.
- Stress is not necessarily bad, but too much stress can harm the animals.
 - Too much and too little are both bad.
 - Stress management is very important for researchers.
 - Social isolation, veterinary procedures, and moving between cages can all cause unneeded stress.
- Current research has NHPs sit in chairs that restrain their movement for testing. They are then isolated.
- One of the first versions of a home-cage training system was used for chimpanzees.
 - Used "changeable metal object pairings" that hid food (Ceccarelli).
 - The chimps could interact with the objects to get to their rewards and a scientist would put other rewards in different spots for more training.
 - Rewards were probably some sort of pellets.
 - Manual system.
- Wisconsin General Test Apparatus (WGTA) was developed.
 - Composed of a tray with hidden food rewards.
 - Experimenter was on the other side of the apparatus to observe at a workstation.
 - They control the plate and the progress of the test.
 - System has advanced with motorized trays and "sensor-based monitoring of NHP movements" (Ceccarelli).
 - Also added "visual object projection screens equipped with reward dispenser" (Ceccarelli).
 - Joysticks were also added.
- Main issue is that they have to move the animals to designated testing cages.
- The Learning Research Center's Computerized Test System (LRC-CTS) could be attached to the cage.
 - Visual task presentation, joystick, and speaker.

- Able to be used voluntarily by the NHPs.
- Home-cage system has two core components:
 - Behavioral Unit:
 - Has parts necessary for "task presentation and interaction, behavioral signal recording, and
 - Control Unit:
 - Computer system that designs, controls, and manages tasks.
- Some have touchscreens or could be replaced by tablets.
- Peristaltic pumps for liquid rewards.

References:

F. Ceccarelli, Fabrizio Londei, G. Arena, A. Genovesio, and L. Ferrucci, "Home-Cage Training for Non-Human Primates: An Opportunity to Reduce Stress and Study Natural Behavior in Neurophysiology Experiments," Animals, vol. 15, no. 9, pp. 1340–1340, May 2025, doi: https://doi.org/10.3390/ani15091340.

- Home-Cage Training Devices are very important to ensure the NHPs are not overly stressed and the experiments can be valid.
- There are a few different types of these training devices from manual ones that require a researcher to be present or more automated ones with touchscreens or buttons and joysticks.



Research - Patent: Primate Training Device

Jackson STEWART - Sep 11, 2025, 9:24 PM CDT

Title: The research system of non-human primate movement and cognitive function based touchscreen

Date: 09/11/2025

Content by: Jackson Stewart

Goals:

- Look into designs that are similar to our design.
- Try to get as much info as I can since the patent is in Chinese.

Content:

- System has multiple different features:
 - Fixed seat.
 - o Touchscreen system.
 - · Water supply system.
 - Eye tracker.
 - · Hand motion tracking.
 - Electromyography recording system.
 - Signal acquisition system.
 - Upper and lower computer.
- · Multiple different training modes.
- "Reasonable design".
- Used for movement, vision, and hearing research.
- The device greatly improves training time.

References:

周瑾 *et al.*, "The research system of non-human primate movement and cognitive function based on touch screen," Apr. 05, 2019 Accessed: Sep. 11, 2025. [Online]. Available: https://patents.google.com/patent/CN109566447A/en?q= (%22primate+training+device%22)&oq=(%22primate+training+device%22)

- There are many features that may be common among touchscreen systems
- I need to find more patents with diagrams that I can read to compare and create more ideas.

Research - Article: IP Ratings for Touchscreens

Jackson STEWART - Sep 21, 2025, 3:45 PM CDT

Title: Exploring Waterproof Ratings: IP54, IP64, IP65, IP67

Date: 09/21/2025

Content by: Jackson Stewart

Goals:

- Learn more about what IP ratings are and what each one is used for.
- Apply that knowledge to find suitable touchscreens for our product.

Content:

- · IP rating stands for Ingress Protection Rating.
- It represents resistance to liquid and solid objects.
- It is used for many different types of electronics.
- A higher number means better protection.
- The first digit shows the protection from solid materials like fingers.
- The second digit shows the protection of the internal components from things like water.
- IP 54 means that it is protected from limited dust and water spray.
- IP 64 means that it is protected from all dust and water sprays.
- IP 65 means that it is protected from all dust and low-pressure water jets.
- IP 67 means that it is protected from all dust and while being submerged into water.

References:

D. Greaney, "Exploring Waterproof Ratings: IP54, IP64, IP65, and IP67," *Ledlightexpert.com*, Jun. 20, 2023. https://www.ledlightexpert.com/waterproof-ip-rating?srsltid=AfmBOooYxPJnqo3I7kKfWnZSFNULEGg81GUq2ZJelg8Whx_9rK-pNdk7 (accessed Sep. 21, 2025).

Conclusions/action items:

• We will need an IP 64 or IP 65 screen for our project.

Title: Touchscreen Ideas

Date: 09/21/2025

Content by: Jackson Stewart

Goals:

· Find a few touchscreens that we could use

Content:

- https://www.i-techcompany.com/12inch-touch-monitor-ip64-water-proof-5-wire-resistive-touch-mpm1210ip-tr.html#proHorizontalTab2 IP 64
- https://www.icpamerica.com/dm-f12a/ IP 65
- https://www.szjawest.cn/embedded-display/12-inch-touch-embedded-solutions-lcd-touchscreen.html?
 _g|=1*t0j59k*_up*MQ..*_gs*MQ..&gclid=Cj0KCQjwxL7GBhDXARIsAGOcmIPdRTXPS0w0iJANHKjAHn2mtAdEJbkhmG4AJPuyOz9KyX5OoH1ywAsa
- https://www.touchtecs.com/capacitive-touch-screen/true-flat-capacitive-touch-screen-ip65-21.5-inch.html?
 gad_source=1&gad_campaignid=14246395363&gbraid=0AAAAABYaPhd17PpwuXHuAq3CYVDMvrMKT&gclid=Cj0KCQjwxL7GBhDXARIsAGOcmIN_IP65
- https://www.i-techcompany.com/15inch-panel-mount-front-ip64-touch-lpmw1560hb-pcap.html IP 64
- https://geekland.co/product/10-inch-industrial-touchscreen-monitor-front-ip65-waterproof-gk-nwy10m/ IP 65
- https://geekland.co/product/12-inch-industrial-touchscreen-monitor-front-ip65-waterproof-gk-nwy12m/ IP 65
- https://lilliputweb.com/lilliput-tk1019/ IP 65
- https://www.alibaba.com/product-detail/12-12-1-Inch-lp65-Waterproof 60578561233.html?spm=a2700.7724857.0.0.57f87572KduppP IP 65
- https://www.xenarcdirect.com/892GFC.html IP 65

Conclusions/action items:

• Most of the ones I could find were IP 65, but there are a ton of options.

Research - Article: What is Raspberry Pi?

Jackson STEWART - Sep 25, 2025, 10:04 PM CDT

Title: What Is Raspberry Pi? Here's The Best Guide To Get Started

Date: 09/25/2025

Content by: Jackson Stewart

Goals:

· Learn about the uses of Raspberry Pi's

Content:

- First published in 2012.
- Good for learning and then applicable in more complex projects.
- · What is it?
 - Small computer that can connect to another computer via USB.
 - Uses standard mouse and keyboard.
 - Has its own processor, memory, and graphics driver.
 - o Comes with Raspberry Pi OS, a modified version of Linux.
 - Can browse the internet and stream high-definition videos just like a normal computer.
 - Can communicate with outside world.
 - Used to learn programming and how computers work worldwide.
 - Low storage, but able to use an SD card and transfer data over the internet.

• Uses:

- o Can make a desktop computer with a raspberry pi, a microSD card, and a power source.
- Can be used in robot controllers.
- Can be used to print things.
- Can be used to run games.

· Applications:

- · Media Streamer.
- Tablet Computer.
- Home Automation.
- o Internet Radio.
- · Robotics Command.
- Arcade Devices.
- o Cosmic Computer.
- · Many types of projects using Raspberry Pi.

· Types:

- o Raspberry Pi Zero:
 - Half the size of the A+ with the same functions.
 - 1GHz single-core CPU
 - 512 MB RAM.
 - Mini HDMI port.
 - Micro-USB OTG port.
 - Micro-USB power

- HAT-compatible 40-pin header.
- Composite video and reset headers.
- o Raspberry Pi 2:
 - Quad-core ARM cortex-A7 processor at 900 MHz.
 - SDRAM of 1 GB.
 - Works with Raspberry Pi 1 without any issues.
- Raspberry Pi Model B
 - More features.
 - Two USB ports.
 - 512 MB of RAM.
 - 100 MB ethernet connector.
- · Raspberry Pi Model A
 - More affordable and smaller Raspberry Pi.
 - BCM2835 system-on-chip (SoC).
 - ARM11 processor.
 - Powerful GPU.
 - Best suited for low-power projects that do not need an ethernet or multiple USB connections.
- o Raspberry Pi 3 Model B
 - Good for strongly linked designs with wireless LAN and Bluetooth.
 - Cheapest processor available.
 - Single Board computer with Broadcom BCM 2837 64-bit ARMv7 Quad-Core processor at 1200 MHz.
 - 1 GB SDRAM at 400 MHz.
- · Advantages of Raspberry Pi:
 - Small and inexpensive computer.
 - A group of Raspberry Pi's is more efficient than a normal server.
 - Can display visuals and movies.
 - o Good for small businesses.
- Disadvantages of Raspberry Pi:
 - Not a good replacement for a normal computer.
 - Cannot multitask.
 - Kind of slow.
 - Windows is incompatible.
 - It takes extra work to use.
 - Not good for large companies with established servers.

References:

"What Is Raspberry Pi? Here's The Best Guide To Get Started | Simplilearn," *Simplilearn.com*. https://www.simplilearn.com/tutorials/programming-tutorial/what-is-raspberry-pi

Conclusions/action items:

• Raspberry Pi seems like the right way to go for our design.

Research - Youtube: How to code on a Raspberry Pi

Jackson STEWART - Oct 03, 2025, 9:34 AM CDT

Title: Program a Raspberry Pi in 7 Minutes

Date: 10/02/2025

Content by: Jackson Stewart

Goals:

• Figure out how to code a raspberry pi.

Content:

- Figure out what model you have.
 - 0 0
 - A
 - B
- · Tools you need:
 - o Keyboard.
 - o Mouse.
 - · HDMI Monitor.
 - Micro SD card.
 - o Micro SD reader.
 - o Power Adapter.
- All but pi 4 require micro USB.
- Need to download an operating system before powering it.
- · Most commonly used is Raspian.
- · Install it on the Micro SD.
- Download balena etcher.
 - This lets us put Raspian on the Micro SD.
- We can now put Raspian on the pi.
- It now works as a normal computer.
- It is a programming platform.
 - Python
 - Java
- Can use pins on pi for other devices.

References:

• https://youtu.be/TLXbfXYHKiU?si=ukCnNshnOR3KPHnq

Conclusions/action items:

• It does not seem too hard to get it all set up.

Jackson STEWART - Oct 03, 2025, 10:01 AM CDT

Title: 10 surprisingly practical Raspberry Pi projects anyone can do

Date: 10/03/2025

Content by: Jackson Stewart

Goals:

• Find out what Raspberry Pis can be used for.

Content:

- · HTPC Media Streaming.
- Make a "dumb" TV smart.
- · File Storer.
- · Wireless Network Printer.
- · Extend Home Wi-Fi Network.
- · Game Emulator.
- Music Streaming Machine.
- Learning Programming.
- · Play Minecraft.
 - Apparently it has its own version.
- Productivity PC.
- · Many types of experiments.

References:

E. editor, "10 surprisingly practical Raspberry Pi projects anybody can do," *PCWorld*. https://www.pcworld.com/article/420028/10-practical-raspberry-pi-projects-anyone-can-do.html

Conclusions/action items:

• The Raspberry Pi is a VERY versatile piece of tech.

Research - Video: How to use LT Spice

Jackson STEWART - Oct 23, 2025, 9:44 PM CDT

Title: LT Spice Tutorial - EP1 Getting Started.

Date: 10/13/2025

Content by: Jackson Stewart

Goals:

 Learn how to use LT Spice so that I an simulate our circuit and find what strength of components we will need.

Content:

- Basic introduction into the uses of LT Spice.
- · Made a very basic circuit.
- Used to simulate circuits.
- Very common. You can google your questions.
- The simulation gives you measurements that you have to interpret.
- · Many basic components.
- · Tap R for resistors.
- Tap P for the components menu.
- Can add units for voltage and resistors.
- Can name parts.
- Simulation easy to start. Shows measured voltages.
- Right click on simulation window to zoom to fit.
- Can plot voltage, amperage, and power.
- Make sure to add grounds.
- · Hold click and zoom to zoom into area of interest.

References:

https://youtu.be/JRcyHuyb1V0?si=Mgw2v8ZotlItCi-o

- I should probably watch more of these videos.
- I desperately need to do more research into all of the components of a circuit.

Jackson STEWART - Oct 23, 2025, 9:57 PM CDT

Title: LT Spice tutorial - EP2 AC simulation and the Baxandall tone control circuit

Date: 10/23/2025

Content by: Jackson Stewart

Goals:

· Learn more about LT Spice.

Content:

- Learn how to make an AC simulation.
- It takes your circuit and finds the point where the DC voltages are constant.
- Octave, Decade, List.
- · Need a voltage source.
- Go into advanced menu and put in AC amplitude of 1.
- Above a certain frequency, it starts to attenuate the signal.
- gain in decibels = 10 times log(volt out / volt in) times decibels.
- Can use potentiometers to calculate amperage of resistors and voltage of wires.
- · Can create steps for parameters.
- Can go between the lines in the graph to find what type of resistor you should use.

References:

https://youtu.be/P_ENvucaZkI?si=5oUEsZOilN5S9rix

Conclusions/action items:

• I have a better idea of how to graph a circuit and how to find what resistors I need.



Research - Video: .param and .step directives

Jackson STEWART - Oct 23, 2025, 10:09 PM CDT

Title: LT Spice tutorial - EP3 . param and .step directives

Date: 10/23/2025

Content by: Jackson Stewart

Goals:

• Learn more about LT Spice.

Content:

- .param is like defining a variable.
- It uses the input in the and uses it in the circuit as a parameter.
- Can be used with lots of math functions.
- The parameter is constant.
- It can be used to give the same value to multiple components.
- Can set a parameter for each part and then set it for each component.
- Can be used to perform mathematical operations.
- Add them with spice directive. It looks like ".t".
- .step gives multiple values to parameters and performs simulations with each of them in the same run.
- Can give values to user given parameters, component parameters, or the system temperature.

References:

https://youtu.be/ARE5nwiHI0Q?si=WLPVExavf37Ptqi

Conclusions/action items:

• I learned how to set parameters.

Jackson STEWART - Oct 23, 2025, 10:36 PM CDT

Title: LT Spice tutorial - EP4 How to import libraries and component models

Date: 10/23/2025

Content by: Jackson Stewart

Goals:

• Learn how to import things like transformers.

Content:

- You first need to look up the model that you want for a spice model.
- You can introduce it into your draft through the spice directive.
- Use the include statement. It works like .inc ______
- Open the files with a text editor. Input your new file into the existing ones.
- Create a new file in your library of your LT Spice files.
- You can create a symbol with your pins. It will add the new symbols to autogenerated.

References:

https://youtu.be/8V5XabccFaE?si=2kgcGkCwJK2a3DMH

Conclusions/action items:

• I learned how to import new components into LT Spice.



Research - Video: Stock example simulations to play with

Jackson STEWART - Dec 10, 2025, 6:38 PM CST

Title: Stock example simulations to play with

Date: 12/10/2025

Content by: Jackson Stewart

Goals:

· Learn more about LT Spice.

Content:

- You can put premade circuits into your LT spice with the select component symbol tab.
- You can then connect these parts to the circuit with the simulate function.
- You can use the educational folder to give you circuits to play around with.
- You can look at voltage and output power at any part of the circuit.
- · You can get many different circuits with varying stability.
- You can also use filters from the same tab.
- Also can try curve tracers.

Conclusions/action items:

• I learned more things that I can input into circuits with LT spice.



Research - Article: What are Watts, Volts, Amps, and Ohms

Jackson STEWART - Oct 14, 2025, 3:27 PM CDT

Title: What are Watts

Date: 10/14/2025

Content by: Jackson Stewart

Goals:

 Learn what watts, volts, amps, and ohms actually are so that I can do the necessary calculations for our circuit.

Content:

- · What is a Watt?
 - Probably the most common unit of electricity for normal people.
 - Wattage is the amount of electricity that a device consumes.
 - Electricity can be thought of as work.
 - The power it takes to actually run something.
 - Wattage can be found my multiplying Voltage (pressure/speed) and Amperage(volume).
 - W = V*A
 - The faster an electron goes through a system, the greater the volume, and thus the greater the wattage.
 - Wattage measured in Watts.
 - o Named after James Watt: Scottish engineer.
- Adoption of the Watt
 - Watts became an SI unit of power in 1960.
 - Actually first used in 1882.
 - Universally used to measure power in many fields today.
- Watt Multiples
 - Kilowatt (kW)
 - 1.000 Watts
 - Often used in appliances and power generation.
 - Megawatt (MW)
 - 1,000,000 watts
 - Often used for large-scale power plants
 - Gigawatts (GW)
 - 1,000,000,000 watts
 - Often used for large energy projects or national grids
 - Milliwatts (mW)
 - 0.001 watts
 - Often used for small electronic devices.
- · What is a Watt-Hour?
 - A watt hour (Wh) is a unit that measures how much work is done when something receives 1
 watt of power for an hour.
 - Helps measure total energy consumption over time.

- o 60 watts lightbulb for 2 hours is 120 Wh.
- Often used in billing or for capacity of batteries or energy storage systems.
- Understanding Volts, Amps, and Ohms
 - Three basic units of electricity are voltage (V), current(I, uppercase "i"), and resistance (R).
 - Volts:
 - Measures Voltage.
 - Measure of electrical potential or "pressure" that electricity flows through a system.
 - Speed of individual electrons through the system.
 - Power in the US is delivered in 120V and 240V.
 - 120V for most devices like lightbulbs, TVs, computers, and phone chargers.
 - 240V for large devices like ACs and clothes dryers.

Amps:

- Measures Current.
- Another way to measure the amount of electricity going through a system.
- It is the rate that current is going through the system or number of electrons going through a wire.
- Amperage is measured in amps (amperes)
- Commonly used in home circuit boxes.
- Larger amperage means more electricity can go through it.
 - 30-amp for ACs, washers, and dryers.
 - 15-amp or 20-amp for most outlets.
- o Ohms:
 - Measures Resistance.
 - Wires aren't perfect conductors, so they will have some natural resistance that can slow the electricity.
 - Electrical devices like appliances also have their own resistances.
- Understanding Electricity: Plumbing Analogy
 - · Use a pipe system as an analogy.
 - Voltage is the water pressure.
 - Current is the flow rate.
 - Resistance is the pipe size.
 - o Ohm's Law:
 - I = V/R
 - Electrical power is measured in watts.
 - Power (P) = V*I
- Electrical Efficiency
 - There is an advantage to having the same power but less current because more current means more power in consumed.
 - since V = I*R, P = I^2*R
 - The power consumed increased drastically if the current increases.
 - Higher voltages can make the system more efficient.

References:

D. Roos, "What are amps, watts, volts and ohms?," *HowStuffWorks*, Oct. 03, 2022. https://science.howstuffworks.com/environmental/energy/question501.htm

- I now know how volts, amps, and ohms are used in electrical circuits.
- We should try to use a higher voltage power bank in our system to maximize electrical efficiency.
- I now need to look into the different parts of a circuit and how they work together.



Research - Article: 12 Commonly Used Components on PCBs for Beginners

Jackson STEWART - Oct 14, 2025, 8:38 PM CDT

Title: 12 Commonly Used Components on PCBs for Beginners

Date: 10/14/2025

Content by: Jackson Stewart

Goals:

• Learn what the basic arts of a circuit are so that I can make a circuit for our power bank.

Content:

- PCB stands for Personal Circuit Board.
- The components on a PCB work together to make a system that works like a city.
- · Resistors:
 - One of the most commonly used components and the easiest to understand.
 - They resist the flow of current by dissipating power as heat.
 - They come in many different types and materials.
 - Axial resistor is most common with leads on both sides and a body with colored rings.
 - The rings indicate their resistance value.

Capacitors:

- Usually only outnumbered by resistors.
- Capacitors temporarily hold electric charge and then release it when that charge is needed somewhere else in the system.
- It does this by collecting opposite charges on two conductive layers that are separated by an insulating or dielectric material.
- Often categorized by the conductor or dielectric material, so there are many different types of them.
 - High capacitance electrolytic capacitors.
 - Diverse polymer capacitors.
 - Stable ceramic disc capacitors

 Some can look like axial resistors, but most have a radial style with leads coming out of the same side.

• Inductors:

- They store energy like capacitors, but instead of storing electrostatic energy, they store it in a magnetic field that generates when current flows through them.
- The simplest on is a coil of wire.
- The more windings of wire, the greater the magnetic field and the inductance.
- They are often wrapped around a magnetic core.







- These amplify the magnetic field and the stored energy.
- They are often used to block certain signals.
 - Blocking interference in radio equipment.
 - With capacitors to manipulate AC signals in switched mode power supplies.

· Potentiometers:

- A form of variable resistor.
- Commonly found in rotary or linear types.
- By rotating the knob of a rotary potentiometer, resistance is varied as the slider contact is moved over a semi-circular resistor.





- A common use of rotary potentiometers is for volume for radios.
- Linear potentiometer is the same, but the resistance is varied by moving the slider contact of the resistor linearly.
- They are good for fine tuning things.

• Transformers:

- They transfer electrical energy from one circuit to another with a change in voltage.
- Voltage is transformed.
- Soft iron core with two or more coils of wire wrapped around it.
- Primary coil or source circuit for the circuit that is transferring energy.
- Secondary coil for the circuit that the energy is being transferred to.
- These are common for industrial use where they transform the several hundred watts of power from the telephone cables to a few hundred volts for typical household use.

· Diodes:

- Diodes only let current run from the anode (+) to the cathode (-).
- It has zero resistance in one direction and high resistance in the other.
- This can be used to block current from going the wrong direction and causing damage.
- The most common one is the light-emitting diode (LED).
- Even though it lights up, it is still a diode.

• Transistors:

- Fundamental building blocks of modern electronics.
- Several billions are in a single IC chip.
- They are amplifiers and switches.
- They come in many types.
 - Bipolar Transistor is the most common.
- They an be split into NPN and PNP versions.
- Bipolar transistors have 3 pins.
 - Base
 - Collector.
 - Emitter.

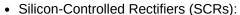


NPN:

 When a small amount of current flows from base to emitter, it starts another circuit that usually causes a large amount of current to flow through the collector to the emitter.

o PNP:

- Directions of current are reversed from the NPN version.
- Field Effect Transistors (FETs) use an electric field to activate the other circuit.



- Also know as thyristors.
- They are similar to transistors and diodes.
- They are basically two transistors working together.
- They have three leads and have four silicon layers.
- They only work as switched, not amplifiers.
- Only a single pulse is needed to activate the switch instead of current needing to to be continuously applied like with transistors.
- They are more suited for switching larger amounts of power.

· Integrated Circuits:

- · Also called ICs.
- Circuited and Components that have been shrunk down onto wafers of semiconductor material.
- A lot of components can fit on a single chip.
- Gave rise to calculators, smartphones, and computers.
- Usually the brains of a wider circuit.
- Typically in a black plastic housing the can come in many shapes and sizes.
- They have visual contacts like leads or contact pads like in BGA chips.

Crystal Oscillators:

- They provide the clock in circuits that require precise and stable timing elements.
- They create a periodic signal by causing a piezoelectric material, the crystal, to oscillate.
- Each one is designed to vibrate at a specific frequency.
- They are more stable, economical, and have a smaller form factor than other timing methods.
- They are commonly used as precise timers or in quartz wristwatches.

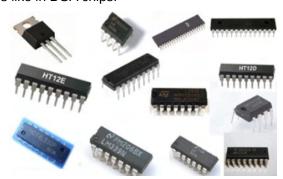
Switches and Relays:

- Switches are power buttons to control the flow of current in a circuit.
- Switches between an open and closed circuit.
- They can be sliders, rotary, push button, lever, toggle, key switches.









- A relay is an electromagnetic switch that that is operated by a solenoid.
- It becomes a temporary magnet when current flows through.
- They function as switches and can amplify small currents to larger ones.

· Sensors:

- Devices that detect changes in the environment and generate an electrical signal about that change.
- Sends the signal to other components in the circuit.
- They convert energy from physical phenomena, so they are basically transducers (convert energy from one form to another).
- Can be many different things:
 - Resistor in resistance temperature detector (RTD).
 - LEDs detecting in-fared signals like a TV remote.
- They can be used to measure many different things:
 - Humidity.
 - Light.
 - Air Quality.
 - Touch.
 - Sound.
 - Moisture.
 - Motion Sensors.

References:

Helen, "12 Commonly Used Components on PCBs for Beginners - Latest News from Seeed Studio," *Latest News from Seeed Studio*, Jun. 12, 2019. https://www.seeedstudio.com/blog/2019/06/12/12-commonly-used-components-on-pcbs-for-beginners/? srsltid=AfmBOorFyvX26ofXLV84all6lxQG RUAvSAl4zuSasZiTrOgeFeiTsva (accessed Oct. 15, 2025).

- I learned a lot about the different components of a circuit.
- This will be very helpful for making a circuit for the power bank for our system.
- I should look into an article that was attached that shows what the colored patterns on resistors mean.
- I should look for some of these components at Wendt Commons when I try to make a circuit.



Research - Article: Resistor Color Codes

Jackson STEWART - Oct 14, 2025, 9:56 PM CDT

Title: Resistor Color Codes and Chart for 3, 4, 5, and 6 Band Resistors

Date: 10/14/2025

Content by: Jackson Stewart

Goals:

· Learn what the color codes for resistors are.

Content:

- Resistors are too small to print numbers or resistive values on.
- · Resistor color codes are used instead.
- Resistors can have 3, 4, 5, or 6 bands.
- The bands are used to denote resistance, tolerance, and temperature coefficient

Color	1 st Band (1 st Digit)	2 nd Band (2 nd Digit)	3 rd Band (3 rd Digit)	Multiplier	Tolerance	Temperature Coefficient
Black	0	0	0	× 10° Ω	N/A	250 ppm/K
Brown	1	1	1	× 10¹ Ω	± 1% (F)	100 ppm/K
Red	2	2	2	× 10 ² Ω	± 2% (G)	50 ppm/K
Orange	3	3	3	× 10 ³ Ω	N/A	15 ppm/K
Yellow	4	4	4	× 10 ⁴ Ω	N/A	25 ppm/K
Green	5	5	5	× 10 ⁵ Ω	± 0.50% (D)	20 ppm/K
Blue	6	6	6	× 10 ⁶ Ω	± 0.25% (C)	10 ppm/K
Violet	7	7	7	× 10 ⁷ Ω	± 0.10% (B)	5 ppm/K
Grey	8	8	8	× 10 ⁸ Ω	± 0.05%	1 ppm/K
White	9	9	9	× 10 ⁹ Ω	N/A	N/A
Gold	N/A	N/A	N/A	× 10 ⁻¹ Ω	± 5% (J)	N/A
Silver	N/A	N/A	N/A	× 10 ⁻² Ω	± 10% (K)	N/A

- Identifying the first band:
 - Increased space occurs before the tolerance band.
 - The bands are not regularly spaced, so they can be seen as being grouped into two.
 - Put the larger group on the left and read it left to right.
 - The first band is usually the closest to the end, but not always.
 - A gold or silver band will always be the tolerance band and should always be last or the rightmost band.
 - You can always use a multimeter to measure the resistance if this does not work.
- Calculating the Resistor Color Codes:
 - 3 Ring Resistors:
 - First two bands always denote the first two digits of the resistance value while the third one represents the multiplier.

- 1st Band 1st Significant Digit.
- 2nd Band 2nd Significant Digit.
- 3rd Band Multiplier
- There is no tolerance band in a 3 band resistor so we use the default tolerance at 20%

4 Ring Resistors:

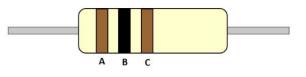
- Most commonly used resistor.
- First two bands are the first two digits of the resistance value, the third band is the multiplier, and the fourth band is the tolerance.
- 1st Band 1st Significant Digit.
- 2nd Band 2nd Significant Digit.
- 3rd Band Multiplier.
- 4th Band Tolerance.
- Sometimes the tolerance band can be blank on a 4 band resistor meaning that the tolerance would be the default of 20%.

• 5 Ring Resistors:

- Has an extra band for a 3rd significant digit.
- The first three bands are the first three digits of the resistance value, the fourth band is the multiplier, and the fifth band is the tolerance.
- 1st Band 1st Significant Digit.
- 2nd Band 2nd Significant Digit.
- 3rd Band 3rd Significant Digit.
- 4th Band Multiplier.
- 5th Band Tolerance.

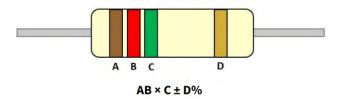
o 6 Ring Resistors:

- Basically a 5 band resistor except the last band denotes temperature coefficient or sometimes the failure rate.
- Most common color for the sixth band is brown which means that for every 10 degrees Celsius change, the resistance value changes by 0.1%.
- 1st Band 1st Significant Digit.
- 2nd Band 2nd Significant Digit.
- 3rd Band 3rd Significant Digit.
- 4th Band Multiplier.
- 5th Band Tolerance.
- 6th Band Temperature Coefficient.

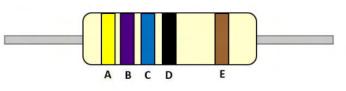


AB × C ± 20%

 $10 \times 10^{1} \pm 20\% = 100 \Omega \pm 20\%$

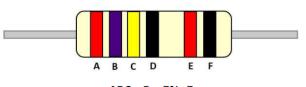


 $12 \times 10^5 \pm 5\% = 1,200 \text{ k}\Omega \pm 5\%$



ABC × D ± E%

 $475 \times 10^{0} \pm 1\% = 475 \Omega \pm 1\%$



 $ABC \times D \pm E\%$, F

 $274 \times 10^{0} \pm 2\%$, 250 ppm/K = **274** $\Omega \pm 2\%$, **250 ppm/K**

- Resistor Color Band Exceptions:
 - Zero Ohm Resistors:
 - They are easily recognized by their single black band.
 - It is a wire link that's only job is to connect traces on a printed circuit board.
 - They look like resistors because components in printed circuit boards are placed using automatic insertion machines instead of being manual.
 - Manufacturers can use the same machine to place components on the board because they look like resistors.
 - This gets rid of the need for a separate machine for installing jumper wires.
 - They are also easier to remove and replace than jumper wires.

References:

"Resistor Color Codes and Chart for 3, 4, 5, and 6 Band Resistors." https://www.seeedstudio.com/blog/2019/04/23/resistor-color-codes-and-chart-for-3-4-5-and-6-band-resistors/

- I know a lot more about how resistors work and how the math behind them works.
- I should look to see what types of resistors they have at Wendt Commons.



Research - Article: Power Supply Basics

Jackson STEWART - Oct 17, 2025, 3:05 PM CDT

Title: Power Supply Basics

Date: 10/16/2025

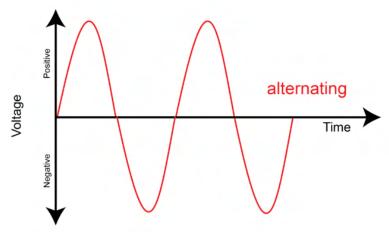
Content by: Jackson Stewart

Goals:

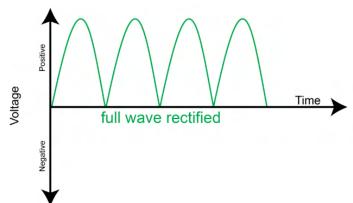
• Learn how power supplies are used to apply it to our project.

Content:

- There are AC supplies, DC supplies, and DC to DC converters.
 - AC mean alternating current.
 - o DC means direct current.
- Power supplies take AC current from the wall and turn it into DC while lowering the voltage with an input transformer.
 - This transformer separates the output power supply from the mains input.
- Transformation of AC to DC:
 - Alternating Current from a Wall Socket:

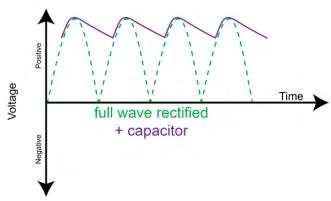


- Voltage is rectified by diodes into a series of positive peaks
- Full Wave Rectified:



 Once rectified, there is still fluctuation in the waveform(time between peaks) that needs to be removed.

- The rectified AC voltage is then smoothed with a capacitor.
 - Used to hold the energy.
- The incoming energy is stored in the capacitor until the voltage falls.
- This decreases the amount of voltage droop and smooths out the voltage.
- A capacitor with a higher storage produces a higher quality supply.
- Full Wave Rectified + Capacitor:



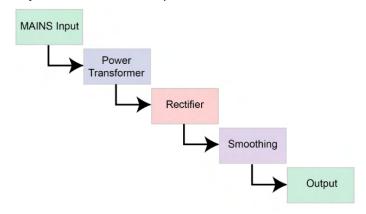
- o One conversion is complete, there will still be a ripple in the output.
- Regulated power supplies use a regulator to create a fixed DC output with less ripple.
- AC power supplies can be regulated or unregulated.
 - Unregulated is the most basic and it does not have the ability to supply consistent voltage to a load.
 - Regulated power supplies can and have many different design options.
- There are multiple different types of converters.
 - o Linear converters are the most basic, but they produce the most heat.
 - Switched converters are more intricate and cooler, but they create more noise.
 - · Batteries are usually switch converters.
- All of the types of converters have their own pros and cons.
 - Which one we use depends on our application of the converter.

UNREGULATED	REGULATED		
Pro:	Pro:		
Simple circuitryDurableCon:	 Voltage is consistent Available in high quality power supplies Noise filtering Adjustable output voltage or current 		
 Voltage varies with load current draw 	Precision tuning Con:		
 Designed for fixed output current or voltage 	ComplexMore expensive		

LINEAR	SWITCHED	BATTERY
Pro:	Pro:	Pro:
Safe and reliable Small residual ripple Less noise Good line & load regulation Stable Con: Poor efficiency Large	Small size, lightweight Wide input voltage range High efficiency Less expensive than linear Con: Complex circuitry Mains pollution	Portable Doesn't require onsite power Con: Fixed voltage input Short life Output voltage droops as energy reserves are used
heatsinks • Large size & heavy • Expensive	Higher noise	

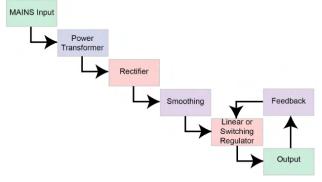
• Unregulated Power Supplies:

- They are usually designed to produce a specific voltage at a specific maximum output load current because they do not have voltage regulators.
- They are typically wall block chargers that turn AC into a small trickle of DC usually for household items.
- The DC output is dependent on an internal reduction transformer and should be matched as closely as possible to the current required by the load.
- The output voltage typically decreases as current output to the load increases.
- The voltage output will vary with the size of the load.
- Usually has a rectifier and capacitor smoothing, but no regulation to steady the voltage.
- May have safety circuits.
- Best for applications that don't require precision.
- They are durable and inexpensive.



Regulated Power Supplies:\

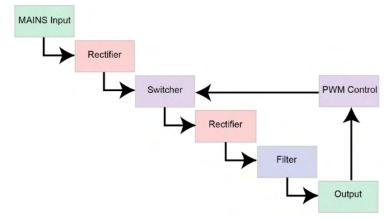
- Essentially an unregulated power supply with the addition of a voltage regulator.
- This lets the voltage stay stable regardless of the amount of current consumed by the load.
- Continuously samples a portion of the voltage and adjusts the system to keep the output at the required value.



- Linear, Switched, or Battery-Based:
 - Linear, switched, and battery-based are the three subsets of regulated power supplies.
 - Linear is the simplest, but switched and battery-based have their own advantages.
 - Linear:
 - Not used when precise regulation and the removal of noise is very important.
 - They are not the most efficient power source, but they have the best performance.
 - They don't need a switch to regulate the voltage output.
 - Very widespread use.
 - Relatively noise free and commercially available.
 - They require larger components, so they are larger and dissipate more heat than switched power supplies.
 - Less efficient than switched power supplies.

Switched:

- More complicated to construct but have greater versatility in polarity.
- Can have an efficiency of 80% or more.
- They are smaller and less expensive than linear power supplies.
- There is a smaller loss across the switch.
- They can radiate noise and interfere with other circuits.
- Shielding and following layout protocols must happen.
- Small and lightweight.
- Wide input voltage range.
- Higher output range.
- Much more efficient than linear supplies.
- Complex circuitry.
- Can pollute the AC mains.
- Noisy system.
- Operate at high frequencies that require interference mitigation.



- Essentially a mobile energy storage unit.
- Produces negligible noise to interfere with electronics.
- Loses capacity and does not provide constant voltage as the batteries drain.
- Batteries are the least efficient method for systems with LEDs.
- It is difficult to get them to match a certain voltage.
- Can also damage the device if the wrong type of battery.
- · Selecting a Power Supply:
 - · Consider voltage and current.
 - o Safety features.
 - Size and efficiency.
 - · Noise immunity of system.
- Important Specs:
 - Output Current:
 - Maximum current that can be supplied to load.
 - Load Regulation:
 - How well a regulator can maintain its output with a load current change.
 - Noise & Ripple:
 - Noise is added and unwanted electronic interference while ripple is the small variation in voltage when AC is converted to DC.
 - Typically combined into one measurement.
 - Measurement given in peak-to-peak for switches because of noise spikes caused by switching.
 - Overvoltage Protection:
 - Shuts down power supply if voltage limit is exceeded.
 - Overload Protection:
 - Safety measure to prevent damage in the event of a short circuit or overcurrent event.
 - Shuts off the power supply so that the load is not damaged.
 - Efficiency:
 - Ratio of power being pulled from the grid that is converted into DC.
 - Efficient systems reduce heat generation and save energy.

References:

"POWER SUPPLY BASICS - Wavelength Electronics," Teamwavelength.com, Jan. 02, 2018.

https://www.teamwavelength.com/power-supply-basics/?

 $srsltid=AfmBOoo8PMImDH0E_YMIRUfP9G3a2GLpnFk1Uu7lDdLnNMrwWD4hzzum\ (accessed\ Oct.\ 17,\ 2025).$

- We need to figure out which type of power supply we want.
- I need to actually look at the options for power supplies so that we can order one.



Research - Website: Linear Power Supply Ideas

Jackson STEWART - Oct 23, 2025, 10:52 PM CDT

Title: Linear Power Supplies

Date: 10/23/2025

Content by: Jackson Stewart

Goals:

• Find some linear power supplies that we could buy.

Content:

• The ones that I found are not super expensive and I think they can all do what we need them to.

References:

https://www.mouser.com/c/power/power-supplies/linear-power-supplies/? srsltid=AfmBOooTUJd6AaPTKSm6i4RMnbfOyl7X60yXkTCs5UGu5y1Wl8MBExMX

Conclusions/action items:

• These would probably work well, but I need to do the calculations to make sure.

Research - Website: 24V Linear Power Supply

Jackson STEWART - Oct 23, 2025, 10:55 PM CDT

Title: DFU240050F1121 24V 500ma AC to DC Linear Regulated Power Supply

Date: 10/23/2025

Content by: Jackson Stewart

Goals:

• Find more linear power supplies that we could use for the project.

Content:

• It looks kind of cheap, but it says it has the correct output for us, so it may work.

References:

https://www.atbatt.com/dfu240050f1121-24v-500ma-ac-to-dc-linear-regulated-power-supply/?srsltid=AfmBOop0UCsi94FxvbNAGaM4URMAbLc0RkE6qGSLSODvzgWmVsSo-gar

Conclusions/action items:

- This could work, but it looks kind of cheap. I need to look more into this.
- The price is very nice though.

Research - Website: 24V DC Power Supplies

Jackson STEWART - Oct 23, 2025, 11:13 PM CDT

Title: 24V DC Switched Power Supply

Date: 10/23/2025

Content by: Jackson Stewart

Goals:

· Learn about some switched power supplies.

Content:

- Just some switched power supplies on amazon.
- Might not be the best, but they are not super expensive and they might arrive quickly.

References:

https://www.amazon.com/24vdc-power-supply/s?k=24vdc+power+supply

Conclusions/action items:

• These would be cheaper and arrive faster than some of the other ones.



Tong Distinguished Entrepreneurship Lecture

Jackson STEWART - Dec 10, 2025, 5:42 PM CST

Title: Tong Lecture

Date: 11/12/2025

Content by: Jackson Stewart

Goals:

• Learn something about entrepreneurship and going for your goals from the speaker.

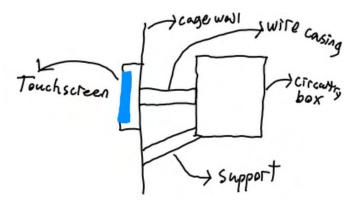
Content:

- She went from BME at UW to an MBA at Harvard to starting her own company "Hopscotch" to being a chief
 officer at Blue Cross Blue Shield.
- A large percentage of our GDP is spent on healthcare, but our system is broken.
- We need more people who think like engineers in healthcare to fix this broken system.
- It is ok to not know where you are going, you just need to work hard toward your goals.

Conclusions/action items:

- I need to keep working on my goals in BME.
- I should look into entrepreneurship in case I am interested in making something like she did.

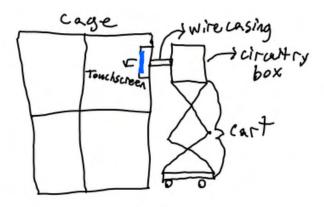
Jackson STEWART - Sep 19, 2025, 9:23 PM CDT



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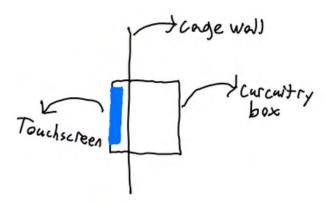
Jackson STEWART - Sep 19, 2025, 9:31 PM CDT



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Jackson STEWART - Sep 19, 2025, 9:28 PM CDT

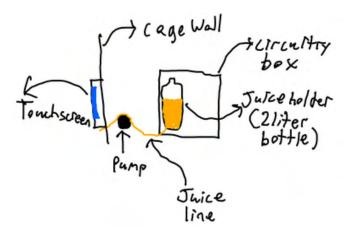


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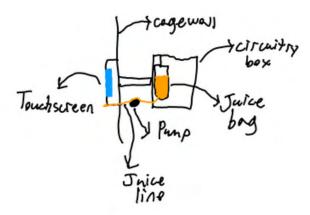


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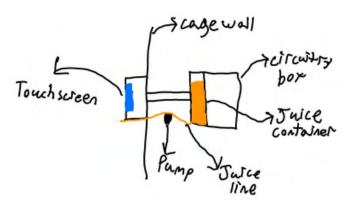


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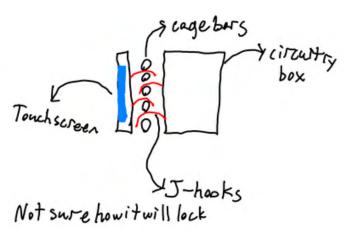
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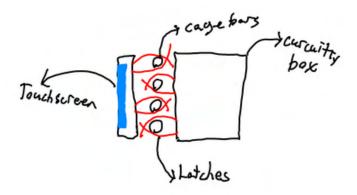
Jackson STEWART - Sep 19, 2025, 9:54 PM CDT



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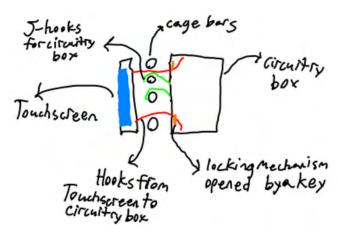
Jackson STEWART - Sep 19, 2025, 9:58 PM CDT



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Jackson STEWART - Sep 19, 2025, 10:04 PM CDT



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Jackson STEWART - Oct 31, 2025, 9:06 PM CDT



My Memberships				
Membership Type	Start Date	Expiry Date	Renew	Card Info
Machining	Wed, Aug 20 2025	Permanent	Not Renewable	N/A
Machining - Training Eligible	Wed, Aug 20 2025	Wed, Dec 31 3000	Not Renewable	N/A
Shop Tools	Tue, Aug 20 2024	Thu, Jan 2 3000	Not Renewable	N/A
Laser Cutter	Tue, Aug 20 2024	Thu, Jan 2 3000	Not Renewable	N/A
Lab Orientation	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A

Profile

Program Registrations

Bookings

Memberships

Orders

Jackson STEWART - Oct 31, 2025, 9:07 PM CDT



This certifies that Jackson Stewart has completed training for the following course(s):

Course	Assignment	Completion	Expiration
Biosafety Required Training	Biosafety Required Training Quiz 2024-2025	10/19/2025	10/19/2028
Chemical Safety: The OSHA Lab Standard	Final Quiz	10/30/2025	
	Data Last Imported: 10/31/2025 08:54 PM		